JOURNAL

VOLUME 8 NUMBER 7 • SEPTEMBER, 1952

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PUBLISHED BY THE SOCIETY OF PLASTICS ENGINEERS, INC.

W. O. Bracken

The President's Message

About this time, following the seasonal lull in business and in our personal activities, such as the Society, it is often advisable and profitable to review and appraise the happenings of the first half year.

The basic, hard work necessary for the sound growth of the Society is rarely spectacular, and we may be guilty at times of overlooking it. Think for a minute about the effort that is represented in the coordination and direction of twenty-six associated groups, totaling 2300 individuals; the detailed and hour-consuming work in getting this Journal to press; the willing sacrifice of time and energy by your local officers and committee chairmen who stimulate and enrich our professional life through their organizational, programing, membership and other activities. Unfortunately, we cannot mention all the individuals, nor can we adequately show our appreciation. They don't expect any kudos, and that may be the key to their enthusiasm: Working and associating with fellows having similar interests in all phases of plastics, locally, nationally, and abroad, is richly rewarding in many ways.

This month, those of you who have had the inclination to get into this royal hassle, but never acted on it, who don't you give it a try?

Let's look at some of the highlights so far this year:

Membership increased by about 300 over last year.

The magazine in professional standing, format, and over-all effectiveness as the voice of SPE, has made gratifying strides forward.

Area professional activity groups are working on the following projects:

Closed mold molding, toxicity of plastics, mold polishing, testing liquid resins, extrusion of rigid PVC, electrostatic properties of plastics, injection molding shop practices, water absorption, military specifications on polythene, compounding and extruding. There is room for you on the committee of your choice. Drop a line to the SPE, Athens, Ohio.

SPE is being represented at the International Standards Organization at Turin, Italy this month by:

Islyn Thomas — Thomas Manufacturing Corporation; C. K. White, Jr. — Hercules Powder Company; Clifford William Welch — British Inst. of Tech. Eng., London, England; Denis Kavanagh — Monsanto Chemical Co., London, England; Ernst Schrenk — Worbla, Ltd., Berne, Switzerland; Niels Jacobsen — Copenhagen, Denmark.

The treasury is rocking along nicely, with satisfactory improvement in the reserve fund.

The new design for the SPE emblem is in the hob stage for the molded pin; perhaps for the Ninth Annual Technical Conference in Boston, January 21, 22, 23, 1953, they will be ready. (Are your plans firmed up yet for this meeting?)

The final returns on the Chicago Conference are in and show it to be the most successful in every respect, to date. That's another example of fellow engineers banding together to tackle a tough job and surpassing the most optimistic expectations.

To date, the national officers, or their representatives, have had the opportunity of meeting the local officers (usually at the section meeting) in Chicago, Eastern New England, Philadelphia, Rhode Island and S. E. Massachusetts, and Southern California.

All in all, it's been a fairly active half year. The next few months should be even more challenging.

Finally, permit me to take a prexy's prerogative. Regardless of whether or not your boy was nominated, let's get out the vote and make your vote count!

W. O. Bracken

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★ From Australia

Dear Sir:

In recent years we have subscribed to your S.P.E. Journal, and I look forward eagerly to its arrival month by month. I know that it is also sought by the senior members of my staff, who constantly enquire for it. I speak for them, as well as myself, when I say that of all the technical journals we subscribe to, we find more down-to-earth practical help in your columns than anywhere else. Some such expression of appreciation has been in my intention for several months, but as so often happens, it has needed a special stimulus to prompt it into words.

With greetings from those interested in the Plastics Industry "down under" in the South Pacific.

Yours sincerely,
E. K. STEWART, General Manager.
COMMONWEALTH MOULDING PTY. LTD.

★ Kline Honored

Gordon Kline was presented with the first annual Honor Award of the Washington, D.C., chapter of the American Institute of Chemists, April 22, 1952. Long-time SPE member Kline is one of the best known plastics men in the country, and is Chief of the Division of Organic and Fibrous Materials of the National Bureau of Standards.

The citation to Dr. Kline reads: "In recognition of his accomplishments and eminence in the field of plastics, his advancement of plastics organizations, and his wholesome attitude of confidence and goodwill toward those with whom he associates."

Dr. Kline's acceptance address, and two appreciations of his work appear in the A.I.C. publication THE CHEMIST for May, 1952.

★ Petretti at Camfield

The appointment of Mario J. Petretti as Manager of the Plastics Division of Camfield Manufacturing Company, Grand Haven, Mich., was announced today by Lawrence V. Meyering, President.

Mr. Petretti, a former National President of the Society of Plastics Engineers, has been a pioneer in the various technical and advisory groups in the industry.

Mr. Petretti comes to Camfield from the Plastics Division of Continental Can Company, Cambridge, Ohio, where he was Chief Engineer.

Camfield's Plastics Division plans to supply to indus-

(Please turn to Page 4)

PLASTICS ENGINEER WANTED

Plastics Engineer experienced in the Production Problems of Polyethylene Extrusion. Wanted to set up and supervise Production Department. Large national organization. Write stating complete background and qualifications, salary, etc. All replies will be held in strict confidence. Reply to: Box 752, Society of Plastics Engineers Journal, Security Bank Building, Athens, Ohio.

REPRESENTATIVES WANTED: Company manufactures complete line of products for plastic industry. Materials also used by mirror, aircraft, and many other fields. Exclusive territories available. Box 852, SPE Journal, Security Bank Bldg., Athens, Ohio.

Preferred for improved STRENGTH ...from coast to coast

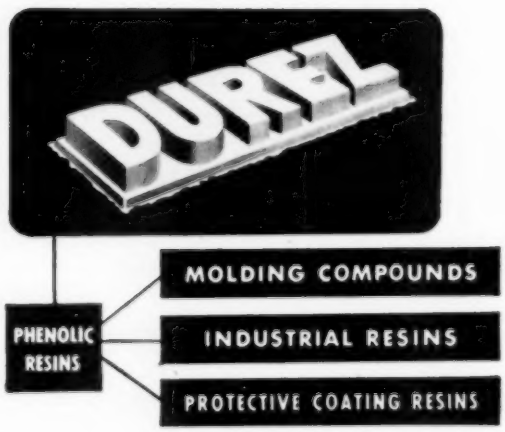
If you compiled a "Blue Book" of the most successful moldings meeting improved strength requirements, black and brown Durez 1544 would dominate it! For years this rugged pair has opened up fields of application in which no other materials give equal satisfaction.

On borderline jobs where strength specifications may be a little high for general-purpose materials, selection of 1544 repays you and your customer alike. It upgrades your work, and assures him of the performance his product is designed to deliver... provides the better value that means more profit for you both.

Durez 1544 preforms automatically without the slightest attention and can be run with equal success in any type of mold—compression, transfer or plunger. With a minimum impact strength of 0.34 foot-pounds per inch of notch and minimum tensile strength of 7,000 pounds p. s. i., it combines excellent electrical properties and a smooth, high-gloss surface.

Durez 1544 Black is designed to meet the requirements of Military Specifications MIL-P-14B and MIL-P-10420 (Ordnance). For sample and complete data, write Durez Plastics & Chemicals, Inc., 1109 Walck Road, North Tonawanda, N. Y.

Use plastics that give more satisfaction on more jobs!



PHENOLIC PLASTICS *that fit the job*

try a completely integrated service in the low pressure glass polyester field, as well as vacuum forming of sheet materials and custom molding of unplasticized polyvinyl chlorides.

★ Fastest Calender

Gentlemen:

Your May issue has come to our attention and we note with interest the illustration and caption on the front cover relating to what is claimed to be the "World's fastest plastic calender" built by Adamson United Co. Similar items have appeared in a number of trade journals and they give the impression that it is the design of the calender which permits film to be run at the speed mentioned, which figures out to be 150 yards per minute. Actually the problem of high speed calendering of film is one of chemical limitations, not mechanical, and we are quite confident that as yet no formula has been developed to take full advantage of the maximum speed claimed for this calender.

About a year ahead of the Adamson calender at Goodyear, a Farrel-Birmingham 32"x92" Z-type calender was installed by Pantasote Co., which is geared to run 150 yards per minute, if a chemical formula is ever developed which could run at that speed. Since it actually is being run considerably below the top speed of which it is capable, we have never made any claims for it. Provision

(Please turn to Page 27)

Injection Molders!

INCREASE PRODUCTION REDUCE SCRAP

with this

IMS Silicone Spray Mold Lubricant

New Non-Clogging All-Metal Valve Removable—Cleanable

Forms a Slick — Quick!

Economical, Too!

Prices:

Per dz. ..... $ 18.00

Gross $197.40

Injection Molders Supply Co.

PENTON BLDG. CLEVELAND 13, OHIO

Management Looks at the SPE

Dale Amos

General Manager, Amos Molded Plastics

Your request of July 7th as to what S.P.E. can do, how, and it's value to the individuals in industry, can best be answered by a review of past events.

At the time S.P.E. was organized the only plastic organization available was for management only. As a result, a need for an engineering society was filled by S.P.E.; however, it wasn't until the last few years that they were able to accomplish their engineering purpose.

Since then S.P.E. has attempted to pass on, by a series of articles, talks, and district meetings, technical engineering information to it's members, along with publishing the S.P.E. Journal. So far so good, but not quite good enough. S.P.E. should co-ordinate all plastic engineering information such as study of new materials, study of equipment, tools, paints and various supplies, etc. They should supply this information in book form to the manufacturing industry of the United States, supplementing this by periodic articles in the S.P.E. Journal by the chairman of the committee covering each phase of the plastic industry.

The writer realizes this is in competition with other hand books presently being published; however, by proper cooperation between the plastic management group and the engineers of S.P.E., duplication of publications can be eliminated and financial assistance probably obtained from the management group.

The individuals in industry will gain through their association with others and through the wealth of information received in these publications and engineering meetings.

"Space ray gun" is molded entirely of BAKELITE Styrene Plastic. Powered by flashlight batteries, it flashes red, white, green light through its clear polystyrene lens. Made by Ideal Toy Co., Hollis, N. Y.

With the Galupee Action Toy, children can put pieces of BAKELITE Styrene Plastic together to create their own toys. Pieces must fit one another tightly, withstand juvenile wear and tear. Molded by Arrow Plastics Co., Passaic, N.J., for Pilot Plastics, Inc., Paterson, N.J.

"Big Chief" bow and arrow set has a strong, flexible, colored bow molded of BAKELITE Styrene Plastic. It's designed to propel arrows 50 feet. Made by Aurora Plastics Corp., Brooklyn, N. Y.

The Magnus super "blow organ" has reeds, keys, and case made of BAKELITE Styrene Plastics for simplified production, compact design, good appearance. Made by Magnus Harmonica Corp., Newark, N. J.

Airport hangar for "Plasticville, U.S.A." is made to authentic scale, has fine details, comes disassembled. Accurately molded sections of BAKELITE Styrene Plastic quickly fit together. Made by Bachmann Brothers, Inc., Philadelphia, Pa.

Merry-go-round intricately molded of BAKELITE Styrene Plastic also has styrene plastic riders moved up and down by styrene plastic cams. A music box provides motive power. Molded by Cowan-Boyden Corp., Providence, R. I., for F.B.A. Industries, New York, N. Y.

For a faster turnover in toyland

Selling these toys is child's play! They're so attractive, children want them—so clever, grownups can't resist them.

And they're all made from BAKELITE Styrene Plastics—easily molded, inexpensive. Their bright-colored surfaces are glossy-smooth or finished in rich decorative detail. Moving parts, musical reeds, pieces that have to be fitted together, are all BAKELITE Styrene Plastics.

Because they're odorless, tasteless, washable—BAKELITE Styrene Plastics provide many characteristics desirable in toys, at lowest cost.

Get more detailed information about how these materials can be applied to your product. Our engineers will help you.

Write Dept. EJ-43.

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THE *Injection* MOLDERSCOPE

By A. R. Morse

President, Injection Molder's Supply Co.

MISSING THE BOAT

It may seem out of place to discuss low pressure laminating and vacuum forming of thermoplastics in a column devoted exclusively to the injection molder — and yet again it may not!

These two fields of endeavor impinge directly on our industry's future — and on the future of BIG injection machines in particular. For some reason many of the old time compression molders originally stood by and kind of scoffed at this then-new injection process. As a result, today there are comparatively few plants that do both types of molding. The injection industry's most spectacular performers are concerns who are devoted exclusively to injection, and which were started as new enterprises mostly during the middle 40's. Estimates put this figure at 60 to 65 percent of the total number of present injection molders.

Is history going to repeat itself? Are low pressure laminators and vacuum forming going to grow up **beside** the injection industry as competitive entities started by new entrepreneurs, or are injection molders going to perceive the opportunities opening up in these spectacular new fields and get into them? At present the signs are mixed, but in general the trend may be again to the new enterprise.

How do these processes stack up against injection on a typical refrigerator panel job? Certainly the mold and machine both cost much more in injection, but then **several** lower cost molds are required for the other processes to equal the same production on the injection mold. The LP laminate may require painting while the vacuum formed part does not, although both may require edge trimming and finishing not needed by the injection molded part. The raw material (polyester resin and fibreglass) in the LP laminate costs more (now) than that in both of the thermoplastic parts. It is therefore vacuum forming that in the immediate future seems to offer the best chance to duplicate most large flat injection molded parts at a substantially lower potential investment and also possibly lower production cost, since there is not much difference in the material cost. There is also some evidence that vacuum formed parts are possibly less brittle and more strain free than the injection molded part. There are admittedly design limitations however that still give a definite advantage to the injection molded part in some shapes and sizes where cross section is important.

What I am getting at is that by vacuum forming in particular you can now duplicate a big injection molded part for a mere fraction of the huge capital investment previously required. Is there any way for the injection molder to meet such a threat besides going into the new field himself?

Another area where injection work can be duplicated at far less investment in molds and equipment is in the new field of vinyl plastisols. Some of the outstanding work produced by Steere Enterprises of Akron for example, from almost (one might say) a stove and a saucepan, is so far superior in appearance and uniformity to injection work that it gives one qualms to consider the manifold (educational) problems still to be met in injection molding of vinyl. Slush molding is yet another area where it is possible to duplicate injection work at a fraction of the investment needed in dies and machines. Furthermore slush molding of vinyl can be used to form articles of shapes that could not possibly be duplicated in injection molds.

There is certainly good evidence, for example, that the purchase of large injection machines should now very definitely be considered in the light of recent developments in vacuum forming, and that investment in special heaters sometimes recommended for vinyl, or injection molds for vinyl parts be reviewed in the light of slush molding and the vinyl plastisol dipping processes now appearing.

The point of these paragraphs is to emphasize that we cannot afford to overlook developments in other areas of plastics as there are things happening that impinge directly on the injection molder and his future, and about which he must keep himself appraised before an economic crisis stares him suddenly in the face.

THE KUSAN FIRE

On July 25, 1952 while the night shift was running their 5 injection machines on the ground floor of the Kusan plant located at Amqui (near Madison) Tenn., a disastrous fire of unknown origin started on the (deserted) assembly floor. By the time the fire was discovered it was too late to stop it, and the plant was reduced to a hulk, with heat-twisted girders draped eerily across it.

Kusan Inc., today one of the country's most original, ingenious and successful designers and merchandisers of unique toy creations was founded by three young entrepreneurs in 1946, Earl Horton, C. A. Horner, and William R. McLain. I remember once raising the question about the (false?) economics of a relatively small company having one plant in Henderson, Ky. another in Madison, Tenn., and a third in Nashville, and Bill McLain gave the final answer to that when he said, "Thank God we **did** separate our operations!"

Bill says that the way the injection industry rallied around him during the trying days after the fire was one of the most inspiring experiences of his life. Within 9½ working days after the fire a new building was put up in back of Kusan's custom slush molding division south of Nashville. Four presses were purchased from Continental Can's Plastic Division being closed down, and operations commenced again within 23 days of the fire.

It has been an inspiring experience — and a privilege — to watch these men (McLain, Horner, and Horton) build an organization second to none in our trade, divide their responsibilities, and produce results. The way they integrated themselves in thermoplastics, and the fine reputation for **complete** originality, quality, and production they have established is a credit to the entire industry. Today it is a far cry from the one press they put into production successfully molding their first Kusan Kubes of stubborn aircraft acrylic scrap (the only material they could get in 1946) to their present integrated operations.

Back to the injection machines that were destroyed. Rubber O rings were charred to carbon inside the valves. Brazing on the tubing (repairs) was melted off, and wiring was completely consumed, but clear fresh oil was still standing in the oil tanks. Damage to the presses seemed spotty, as though the fire developed local hot spots. It is virtually impossible to assess damage to the main structural members in a case like this from visual inspection. The Kusan Fire Story reads like a novel and contains many educational pointers that Bill McLain correctly says belongs in the injection molder's file. It is the first such serious loss in the history of the injection industry and no precedents exist for pricing such a big overhaul as this. The final basis of settlement on the insurance involved is also going

(Continued on Page 26)

Properties and Applications of P

By H. F. Robertson

Manager of Development, Thermoplastics
The Bakelite Co.

History

ALTHOUGH VARIOUS unsaturated hydrocarbons, of more or less complex structure, were first polymerized many years ago, the simplest unsaturated hydrocarbon, ethylene, successfully resisted all efforts to convert it into useful solid polymers until early in 1933. Prior to this only liquid materials of low molecular weight had been directly synthesized from this gas while small amounts of solid hydrocarbons had been made by an indirect method from substituted hydrocarbons containing bromine or nitrogen. (1)

Rapid progress followed the discovery in 1933 (2) in the laboratories of Imperial Chemical Industries, that solid polymers could be made directly from ethylene by subjecting the gas to sufficiently rigorous conditions of temperature and pressure. Some years later, a process developed at the Tonawanda, New York, laboratories of Linde Air Products Company, resulted in the production there of development quantities of polyethylene resin having a relatively high molecular weight. Because of the urgent need for adequate supplies of the material for the war effort, production units were built by E. I. duPont de Nemours & Co., Inc. at Belle, West Virginia and by Carbide and Carbon Chemicals Company at South Charleston, West Virginia. The latter plant was designed on engineering data which were obtained as far as possible from the Tonawanda pilot plant operations. Production started in 1943. These plants succeeded in making substantial quantities of urgently needed resin for use in the construction of radar and other cables for high frequency use.

Manufacture

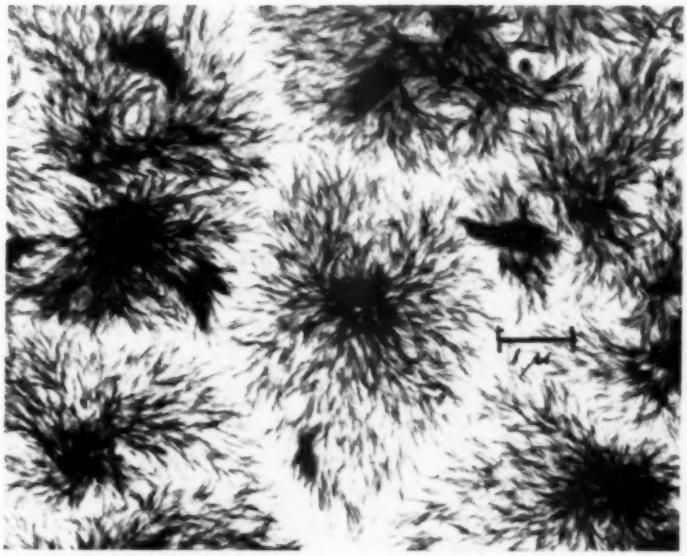
Polyethylene is manufactured by subjecting ethylene to elevated temperatures and very high pressures in the presence of a suitable catalyst. There are many engineering problems involved in the design and maintenance of the equipment used. For example, the compressors and piping must operate safely and continuously under pulsating loads at extremely high pressures. The efficient and safe operation of such equipment requires a careful choice of materials of construction and proper machine design so that damaging stress concentrations are avoided. In addition to the problems imposed by the high pressures used, there are various others both mechanical and chemical in nature. As in the case of most polymerization reactions, monomer purity is of great importance and has considerable influence both on the efficiency of the process as well as on the quality of the polymer made. The variables of pressure, temperature and catalyst concentration have the same effect on the rate of reaction and the molecular weight of the polyethylene produced as they have on most other addition polymers. Higher temperatures give higher conversions and lower molecular weights. Conversely, lower temperatures give lower conversion rates and higher molecular weight resins. Higher pressures, like higher temperatures, give higher conversions but unlike higher temperatures, they result in higher rather than lower molecular weight resins. Catalyst concentration is somewhat similar in its effect as temperature with higher concentrations giving higher conversions but lower molecular weight resins.

Properties

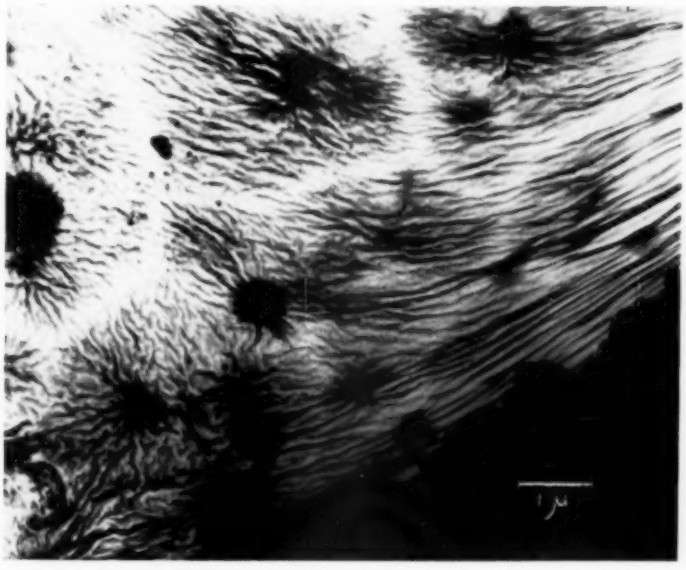
As is the case with all products of polymerization, the properties of polyethylene resins depend to a large extent on their average molecular weight, on the distribution of the higher and lower polymers that go to make up that average molecular weight, and the ratio of straight chain to branch chain material that is present. All of these variables are more or less controllable in the polymerization step. Accordingly, in discussing the properties of polyethylene resins, it is necessary to cover products having a relatively wide range of properties. As might be anticipated from the fact that the polyethylene resins are paraffinic in nature, they are relatively inert chemically, have outstanding electrical properties because they are relatively non-polar and are characterized by lack of odor, taste and low toxicity. As also might be anticipated, such properties as tensile strength, stiffness and abrasion resistance increase markedly with increasing average molecular weight.

Polyethylene resins are "crystalline" polymers with 55% (3) to 73% (4) of the methylene groups being present in crystallites. The amount of crystallinity present varies with molecular weight, the lower polymers in a similar series containing less and the higher polymers more.

Polyethylene . . . .



Brown has made X-ray diffraction studies on oriented and unoriented polyethylene films (5). Figure 1 is an electron micrograph made by him which shows that the crystallites are randomly oriented in unstretched polythylene. Figure 2 shows the crystallites in a partially stretched film of polyethylene and indicates an area where the crystallites are no longer randomly oriented in the stressed region. The dark mass in the bottom right hand corner is a dust particle which served a useful purpose. The film was so thin that it could not be stretched by the usual mechanical means so advantage was taken of the presence of the dust particle. When this was hit by the electron beam it stretched the film the correct amount.



Possibly the mechanical properties of polyethylene, because they are involved in the performance of molded parts and extruded sections, are those of most interest. Figure 3 shows a typical low-magnification stress-strain curve for polyethylene. Although the literature and even the table of physical properties previously shown, give the ultimate elongation of polyethylene (for the higher molecular weight resins) as 500 to 600 per cent, such figures should be used with caution. Elongations of this order always include a large amount of cold drawing. The reported elongation values of 500 per cent have led some to conclude that polyethylene is "rubber-like" or "elastomeric" in nature. It should not be so considered but should be treated more like a metal which is amenable to cold drawing. From the curve shown in Figure 3 it is apparent that permanent deformation of a part will take place, if it is stressed at an elongation value which is much below the final elongation obtained at break. This, however, is not the only consideration involved. Polyethylene parts will sometimes fail by cracking under relatively low stresses. This tendency depends to a great extent on the geometry of the piece, its environment and the nature of the stress involved. The geometry of the piece is affected by scratches, holes or other discontinuities which concentrate the stress in the sample. The presence of various liquids such as alcohols, wetting agents, etc. are environmental factors influencing stress-cracking while biaxial stresses appear to have considerably greater influence on this property than do monoaxial. (6) Carey, Schultz and Dienes have studied this problem. (7) They report that polyethylene pieces cannot be safely strained above about 7 to 8 per cent when certain liquids or when mechanical nicking or scoring are present. Under certain conditions, when such factors are not present, strains as high as 40 per cent may be tolerated. Such properties do not constitute a serious limitation in the use of polyethylene but should be taken into consideration when designing any item involving this product so that satisfactory performance will be obtained. Other high modulus plastics such as polystyrene, the rigid vinyls and methyl methacrylate show this same stress cracking tendency which has been compared by Carey to the stress-corrosion cracking obtained in metals for which cracking occurs in mildly corroding environments. Some idea of the relative magnitude of the change in breaking strength of injection molded polyethylene pieces may be seen in Table I. These data were reported by Carey. (8)

Table II lists the properties of polyethylene resins ranging in molecular weight from 1,000 to 38,000. As indicated previously it will be noted that several of the physical properties such as tensile strength in-

TABLE I

Tensile Breaking Strain of Injection Molded Polyethylene Nominal Values Over a 2" Gage Length—1/16 Hole Environment

Sample	Air	Distilled Water	Soapy Water	Ethyl Alcohol	n-Amyl Alcohol	t-Amyl Alcohol	Toluene
1	51	60	51	18	6	7	14
2	62	54	41	38	15	13	18
3	39	42	46	36	20	20	14
4	45	45	51	44	25	20	21
5	42	44	44	40	29	26	20
6	48	47	47	44	36	38	38

TABLE II

Properties of Polyethylene Polymers

Designation	Mol. Wgt.	Softening Temperature °C	Viscosity @ 130°C. Poises	Tensile P.S.I.	Ultimate Elong. %	50% Brittle Temp. Index Deg. C ASTM D746-447
DXL 1	1000	37.5	0.4			
DYDT	4000	93	5.2			
Resin DYGT	7000	98	120	615	40	-16
Resin DYJT	10000	100	8×10^2			
Resin DYLT	12000	104	3×10^3	910	100	-18
DXL 14	14000	104	14×10^3			
DXL 16	16000	106	50×10^3			
Resin DYNF	19000	108	4×10^5	1400	500	-55
Resin DYNH	21000	110	1×10^6	1600	500	-75
Resin DYNJ	23000	111	1.5×10^6	1800	500	-85
DXH 28	28000	112	3×10^7	2000	500	-100
DXH 34	34000	112	1×10^8	3000	625	below -105
DXH 38	38000	112	3×10^8	3000	625	below -105

TABLE III

Permeability of Films

Film	Oxygen* cc/sq. in./24 hrs.	Water Vapor** g/sq. in. 24 hrs.	Carbon Dioxide*** cc/sq. in. 24 hrs.
Rubber Hydrochloride	0.4	0.0190	9.3
Regenerated Cellulose (450 MSAT)	0.1	0.0290	less than 0.5
Polyethylene			
.001" thick	2.1	0.0050	26.0
.002" thick	1.1	0.0041	10.2

*Determined at 75°F. and 75 per cent relative humidity.
**Determined at 95°F. with dry air on one side and saturated air on the other side.
***Determined at 75°F. and 0 per cent relative humidity.

TABLE IV

Permeability of Films

Film	Thickness	O₂ Permeability* cc sq. in. 24 hrs.
Vinyl chloride	0.0010	0.19
Polyethylene	0.0010	2.60
Rubber hydrochloride	0.0012	0.55
Regenerated cellulose	0.0010	0.09
Rubber hydrochloride		
Regenerated cellulose laminate	0.0032	0.0002
Polyethylene		
Regenerated cellulose laminate	0.0030	0.0002

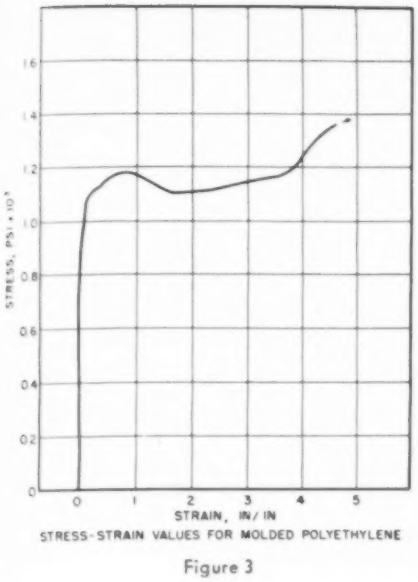
*Determined at 77°F. and 60 per cent relative humidity.

crease with increasing molecular weight.

Some studies have been made on the weathering properties of pigmented and unpigmented polyethylene formulations. One of the first changes noted on outdoor exposure is an increase in power.

It has been found that after six months' exposure a brown compound shows very little change in power factor while surface crazing just begins to appear after fifteen months. A considerably more rapid increase in power factor and the development of surface crazing appear in a white pigmented formulation as well as in an unpigmented compound. It is of interest that observations have been continued on the DEM-892H Black and the DE-6401 Brown since these data have been published. At the present time after forty-six months' exposure the power factor on the black compound is 0.00435 with no change in surface appearance and the power factor of the brown compound is 0.00207 with the surface of the sample showing very shallow crazing. The power factor of the black material has remained essentially constant since reaching the value found after eight months' exposure.

Another physical property of polyethylene which may be of interest to you is the melt viscosity. In hot melt applications which involve the spreading of molten polyethylene or polyethylene-paraffin wax mixtures on paper, low melt viscosities are desirable. Figure 4 illustrates the melt viscosities of polyethylene resins of 7,000, 12,000 and 21,000 molecular weight. Polyethylene resins are substantially insoluble in all solvents at room temperature. However, their solubility rises rapidly with increasing temperatures and solutions of adequately high solids content for various coating uses can be prepared at elevated temperatures. However, as the resins precipitate from solution upon cooling, the solvents must be removed in the drying operation at a temperature above the precipitation point. Because of this difficulty, solutions are not used and it seems preferable to employ hot melts even if somewhat higher coating temperatures are required. Figure 5 shows the solubility in three different solvents of a grade of polyethylene of 21,000 molecular weight. It will be seen that the solubility increases very rapidly with rising temperature. Although polyethylene is substantially insoluble in all solvents at room temperature, it has a relatively high absorption for and permeability to a large number of fluids. In general, both absorption and permeability are a function of the polarity and molecular size of the liquid in contact with the polyethylene. Parliman (10) has determined the permeability of polyethylene to a large number of liquids. Because of



STRESS-STRAIN VALUES FOR MOLDED POLYETHYLENE

Figure 3

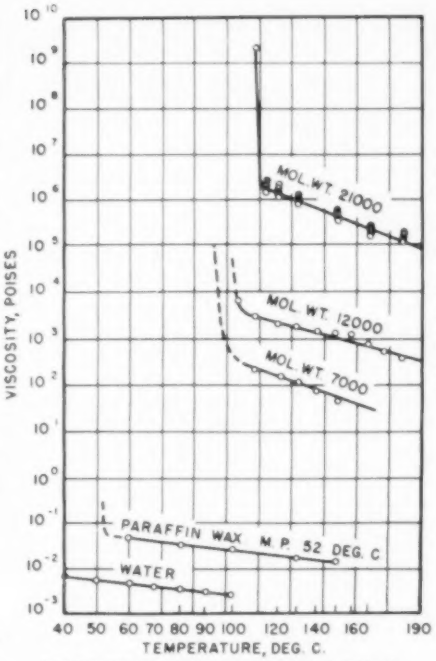
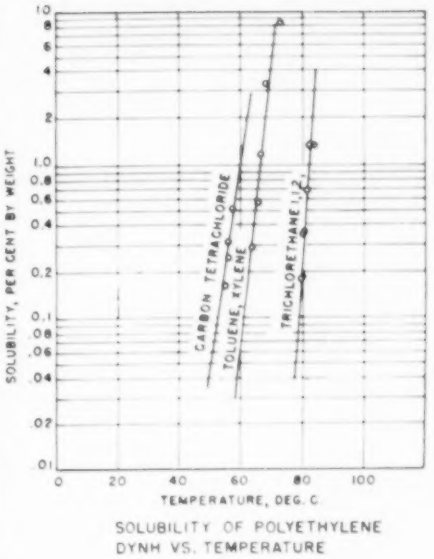


Figure 4 →

MELT VISCOSITIES OF POLYETHYLENE RESINS



SOLUBILITY OF POLYETHYLENE DYNH VS. TEMPERATURE

Figure 5

the increasing use of polyethylene films and molded containers for packaging applications, such data are of utmost importance in determining whether or not the material can be used satisfactorily. The absorption of various liquids by polyethylene appears to vary between wide limits depending on the nature of the liquid that is held in contact with the resin. Table V shows the swelling indices of a representative number of liquids.

TABLE V

Swelling of Polyethylene Resin (Mol. Wt. 21,000) in Liquids

Test Liquid	Swelling Index at 60°C. (Per cent volume change of resin at equilibrium)
Methanol	Negligible
Water	Negligible
Lactic Acid	0.015
Propylene glycol	0.13
Linseed oil	0.45
Castor oil	0.65
Ethylene glycol monoethyl ether	0.95
Tricresyl phosphate	1.3
Di-2-ethyl hexyl phthalate	4.5
Methyl ethyl ketone	6.4
Mineral Oil ("Socony" No. 309)	8.7
Silicone liquid (Type 500, Viscosity 0.65 cstk.*, 25°C.)	9.5
Xylene	19.5
Chloroform	21.0
Benzene	23.0
Dichlorobenzene	26
Tetrahydronaphthalene	36

*1 cstk.—kinematic viscosity unit corresponding to centipoise; 1 cstk.=0.01 stoke

It will be seen that polyethylene is very selective in its absorption characteristics, with the swelling indices varying between a negligible value for water and liquids which contain a relatively large amount of oxygen, to much higher values for hydrocarbons and other liquids deficient or lacking in oxygen.

Because of the wide and increasing use of polyethylene film in packaging, some data on the gas permeability may be of interest. Table III illustrates some of the measurements that were made at the laboratories of the Linde Air Products Company.

It will be seen from this table that polyethylene film has a comparatively low water-vapor permeability and a comparatively high oxygen and carbon dioxide permeability. Other tests made at the same laboratory, (11) using a novel method of oxygen permeability which involves the change in color of the filament of a tungsten lamp bulb in the presence of small amounts of oxygen, are shown in the next table.

The high oxygen and carbon dioxide permeability which is characteristic of polyethylene film has considerable practical application in the wrapping of fresh vegetables. Vegetables continue to absorb oxygen and give off carbon dioxide after being harvested. In case the oxygen is not available from the atmosphere it is obtained by the decomposition of the vegetable itself, with resultant spoilage. Accordingly, any film that will allow the transmission of adequate amounts of oxygen in one direction and the elimination of the carbon dioxide that is built up in the other and which at the same time will prevent the vegetables from drying out, will result in much greater package life. However, for some vegetables, the gas permeability of polyethylene is still not sufficiently high and perforation of the package is recommended in order to improve the keeping qualities of the vegetable. This is particularly true with those having a relatively high respiration rate and for vegetables that are stored at ordinary temperatures. Table VI illustrates some data that were obtained on the shelf-life of California iceberg lettuce in some tests that were carried out at the Linde Air Product Company's laboratories.

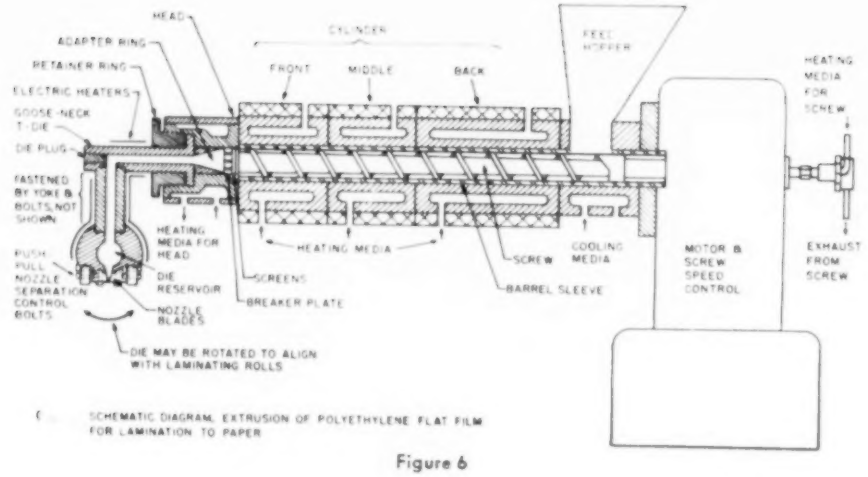
TABLE VI

Shelf Life of California Iceberg Lettuce

Film	Number of Samples	Average Shelf life in days
None	4	2.0
Regenerated Cellulose	10	7.8
Rubber Hydrochloride	10	7.3
Polyethylene .001" thick	5	8.5
.002" thick	10	10.0
.003" thick	10	9.0

Fabrication

Polyethylene resins are capable of being fabricated by compression and injection molding, by extrusion, by calendering and by various coatings methods including flame spraying, spreading of hot melts and solution casting techniques. The most important of these, from the point of view of being the largest consumer of polyethylene, is extrusion. Extrusion equipment is used for the production of insulated wire and cable, for the coating of paper by laminating a flat extruded film with paper and for the production of unsupported film by the extrusion and subsequent drawing down of flat sheet or tubing.



SCHEMATIC DIAGRAM, EXTRUSION OF POLYETHYLENE FLAT FILM FOR LAMINATION TO PAPER

Figure 6

Figure 6 is the schematic diagram of an extruder used in the production of flat film for lamination to paper.

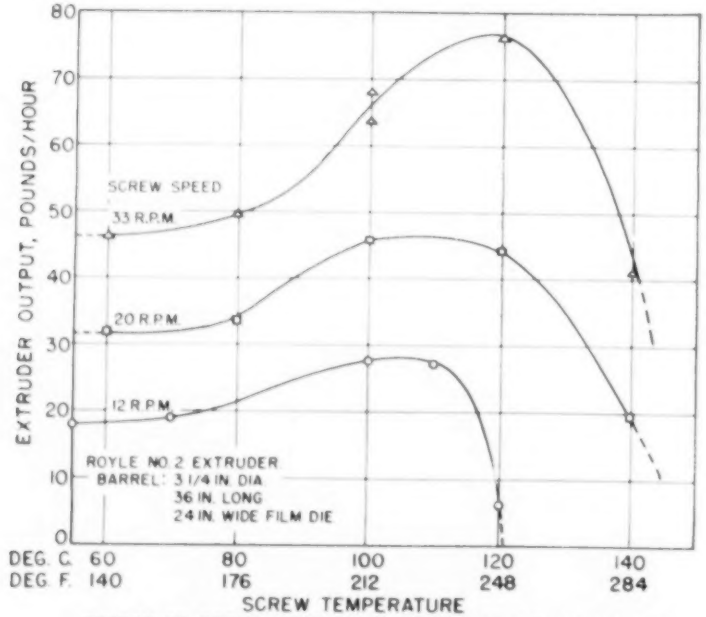
It will be seen that it is a conventional piece of equipment. Polyethylene is fed into the hopper and is softened by heat applied to the cylinder and by the frictional heat generated in passing the material through the cylinder. In the case of coated paper, resin with a molecular weight around 21,000 is generally used. As has previously been indicated, polyethylene has a relatively sharp melting point. However, at temperatures just above this melting point, the material under shearing stresses has an elastic as well as a viscous component. This elastic component gives "nervy" compounds that are difficult to extrude. Accordingly, temperatures considerably above the melting point are used in extruding polyethylene in order to eliminate, in so far as is possible, the elastic component. The compound temperatures usually employed are of the order of 200°C. Temperature measurements made on a typical extruder are shown in Table VII.

TABLE VII

Extrusion Conditions for Polyethylene Extrusion

Cylinder Hopper	20°C.
Back of Cylinder	100°C.
Middle of Cylinder	175°C.
Front of Cylinder	220°C.
Head of Cylinder	240°C.
Die	250°C.
Screw Coolant	40-85°C.
Compound temperature	200-220°C.

Figure 7 shows the effect of screw speed on temperature and output rate.



EFFECT OF SCREW SPEED AND TEMPERATURE ON OUTPUT RATE

Figure 7

Polyethylene is also successfully used in conventional injection molding machines. As in the case of the extrusion, adequately high compound temperatures are desirable and these should be of the order of 200°C. or higher. Polyethylene has a relatively high shrinkage compared to other plastic materials and due allowance should be made for this fact in designing molds. A shrinkage of 2.5 to 3.5% is normally encountered for DYNH grade of resin. This varies to some extent with mold and cylinder temperature and the plunger pressure used. The use of warm molds favors improved gloss. Molding pressures depend to some extent on the size and shape of the casting and are generally below 10,000 p.s.i. at cylinder temperatures of 175 to 260°C.

Calendering

Some polyethylene film or sheeting is prepared by calendering operations. However, the great bulk of film made is produced by extrusion. Standard calenders can be used.

Applications

The original and still the most important application for polyethylene is the wire and cable field. Here its good electrical properties, moisture resistance and lightness make it of interest both as a primary dielectric for high frequency applications and as a jacketing material for power and communication cables. One of the most publicized of such applications is its use as a jacket on Alpeth cable, where it replaces lead. It is currently being used in very substantial quantities in several wire and cable applications involved in the defense effort. It is found almost universally in all television installations as the dielectric in 300 ohm twin lead wire.

Polyethylene film has shown tremendous growth in the packaging field. Mention has been made of this use in wrapping vegetables. However it has been used for wrapping many more products. It is particularly useful for wrapping those materials which rapidly deteriorate the usual cellulose wrapping materials. The wrapping of peat moss and fish bait are examples. Rose plants have been found to survive much longer when wrapped in polyethylene film. Because of its good low temperatures, it is also widely used for refrigerator bags and for wrapping various meat products. One of the more recent applications involves the construction of large balloons designed to travel to the stratosphere. Here again, the low temperature properties of polyethylene allow it to successfully go through a critical low temperature zone which tends to destroy other films by cracking. Polyethylene can be extruded into monofilaments and then cold oriented to give filaments of high tensile strength. These can be subsequently woven on ordinary fabric looms to give materials which are of use as automobile

(Continued on Page 26)

Chicago's President

By M. A. Self

Maurice Meltzer

The politicians whose boast is "something for everyone, from the cradle to the grave," have nothing on Maurice Meltzer, current president of the Chicago Chapter of SPE. Mr. Meltzer actually manufactures something for everyone, from the cradle to the grave, and he delivers, too.

As vice-president of Service Plastics, Inc., Meltzer produces plastic handles, knobs and corners for Storkline baby buggies, children's toys for a whole variety of toy companies, rubber balloons for growing children, and school supplies for the youngster. When the teen-ager begins high school, he starts getting his own radio which is almost certain to be housed in a Service Plastics case and tuned with the company's plastic knobs. If the high-schooler is interested in jive, his phonograph very probably has Meltzer parts in the record player. Driving his parents to distraction by borrowing the family car, the college boy gets his own auto, which probably has Service Plastics' parts on the dashboard, or as ornaments on the car.

Later married, the young man installs his wife in a cabinet kitchen, and the rollers and gears on all the drawers turn out to be Meltzer's nylon parts. His wife's cold cream and other cosmetics are in Meltzer's plastic jars; their baby first learns to drink from one of Service Plastics' tumblers; their new house has Meltzer's plastic numbers on it; the pictures in their living room are encased in Meltzer's plastic frames. Whenever the husband gets thirsty, he is attracted by one of Service Plastics beer signs — and so it goes. Even on that last day, when the white horses march to the cemetery, the casket will have a religious ornament on it— by courtesy of Maurice Meltzer and the Service Plastics, Inc.

Despite the fact that Service Plastics makes its mark in everybody's daily life, the company itself is a modest establishment with only 42 employees. However, the productivity of the establishment may be gauged from its six presses: two 8-ounce; one 12-ounce; one 24-ounce; one 32-ounce and one 60-ounce. Annual volume this year will top $1,000,000.

Meltzer attributes the success of his company to a fervid desire to meet the customer's needs when he wants it and how he wants it. There is no tolerance that Meltzer will not try to meet for a customer, or delivery date. Founded in 1945 by Meltzer, Wm. W. Wright and Charles Karels, the company still does work for its first customer — Leetex Rubber Products. At that time, Leetex wanted some plastic mouthpieces for holiday squawkers, and Service Plastics eagerly asked for the chance to produce them. In rapid fire order came Zenith Radio, Storkline, Morgan Manufacturing Co., and others. These companies are still among the valued customers of Mr. Meltzer.

As a salesman he is distinctly low pressure, anxious to talk about anything but plastics. Pressed to name his favorite topic, he will shyly introduce golf, and from there on there is no stopping him or his demonstrations. He will describe every shot he made in the past two weeks, if you let him. If you let him, he will also describe every blade of grass which caused his putt to roll off. His usual score is in the low 80's; a 79 score one day so elated him that his companions made him stay under a cold shower for 20 minutes to calm him down. As things stand now, he is the most active force at SPE meetings — for having more and more golf outings.

His views on the plastic industry indicate that it is as wide as the country, and has practically no limits. Always anxious to improve, his current complaint is that the industry today needs better materials for bigger parts and bigger presses. Time was, he says, when materials were way ahead of the presses or the market. Now, he feels, the machinery producers have surged ahead and can do more than the materials permit. He thinks everything — but everything — ought to and can be made of plastic, if the material producers would only hurry up and improve the materials to meet the particular needs.

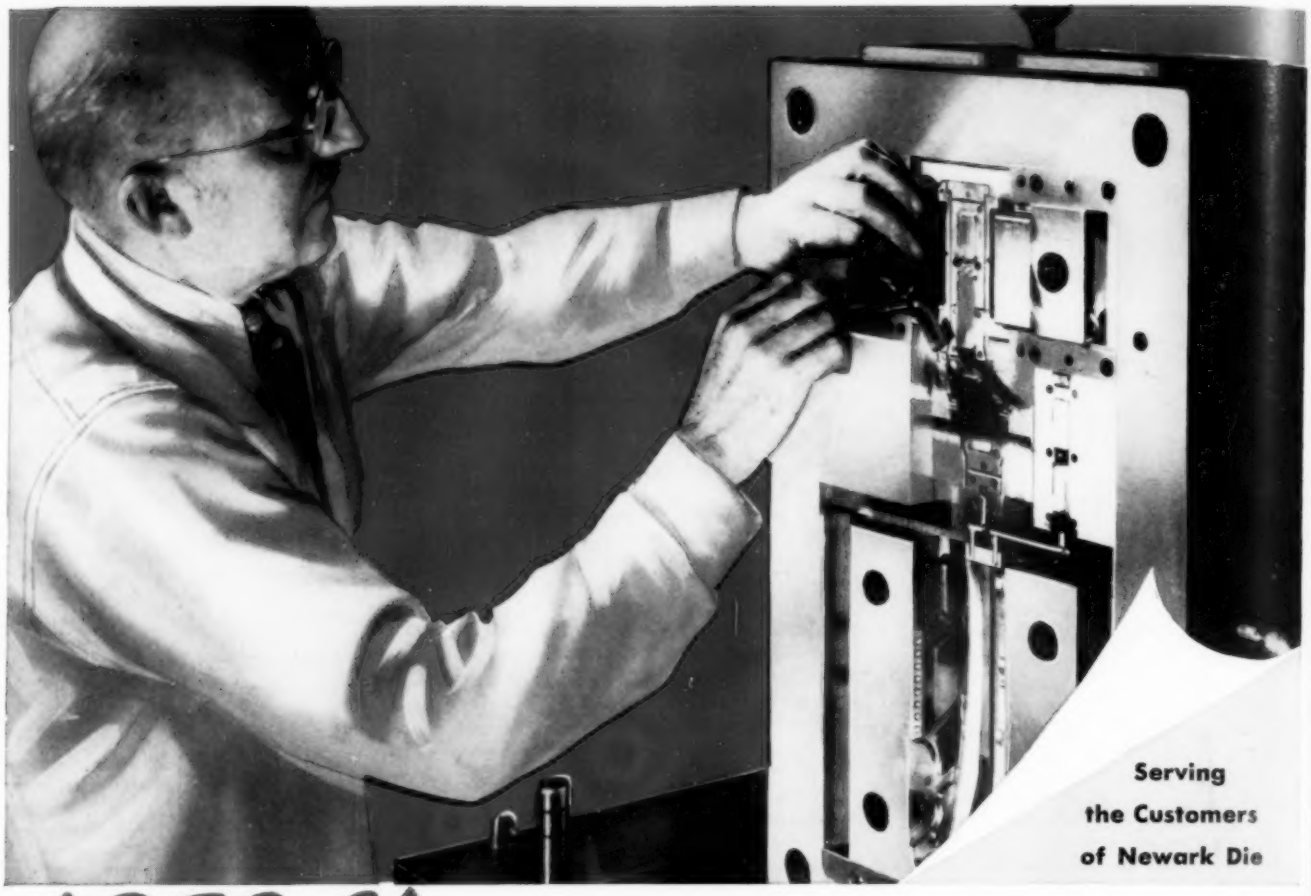
In this connection, he regards the SPE as one of the most valuable organizations he has ever joined. Because it brings together the molders, material suppliers and machinery producers, and enables them to stimulate and needle each other, he feels that improvements will come faster all along the line.

His advent into the plastics business was unheralded at the time. No lightning flashed in the skies. In 1939, he was working for Firestone Tire & Rubber Co. in Chicago, when he noticed a Superior Plastics Co. ad in the **Chicago Tribune** asking for "a man with brains in preference to a man with brawn." After long reflection, he decided he was exactly the shipping clerk being sought. So he wrote a letter modestly stating his qualifications for the job. He received a return postcard telling him to report for work at 9:00 A.M. two days later. That was in 1939. Over the years he ruminated over that incident, but never did find out whether he was the only applicant to answer that ad, or whether he actually was picked for his brains.

However, his progress left no doubt in other minds. By 1945 he was production manager, purchasing agent, personnel director and general manager. In between, he checked on credit. However, the itch to own his own establishment was too great, so together with Wright and Karels (the latter two also once connected with Superior Plastics) they embarked on the new venture. Today they regard their original venture as too daring, too risky, but evidently their Big Chance paid off.

The biggest problem of Service Plastics, Inc. was how to allocate the company titles to the firm's three partners. With the wisdom of Solomon, Meltzer suggested that they choose titles by picking straws. The end of this story should be that he picked the president's title, but Bill Wright was faster on the draw, and got top billing. Actually the three partners couldn't get along without each other. They are virtually interchangeable, except in golf scores, and of course, to their wives.

Meltzer does not play golf all his spare time; he also spends some time at home. That accounts for his four youngsters; two boys and two girls.



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Successful Designing for Plastics Molding

By W. M. HALLIDAY

Proper design makes possible simple cores and hence faster and more economical production

THE CONSTRUCTION and method of operation of a mold, whether it be of the compression or injection type, may often be considerably complicated and increased in cost if the component has to be fashioned with internal or external undercut portions of the kind illustrated in Fig 1.

The reproduction of the type of component shape shown at A (Fig. 1) will, for example, present several difficulties for the mould designer, and toolmaker charged with making a tool for such a part.

This diagram is a cross-sectional outline of a hollow receptacle which may be either cylindrical or rectangular. It will be specially noted that this part has to be formed with an enlarged recessed portion "b" moulded between the base and the side walls on the inside of the container. This recess is located at the base of the internal opening as indicated, and the width of this portion is greater than the remainder of the internal opening, thereby creating an undercut within the component.

If such a component were to be produced as a compression moulding it would become necessary to employ a split kind of core plug for the formation of the entire internal shape, so that the enlarged recess "b" could be satisfactorily formed. After moulding-cure, the tool would be opened along the partingline "a—a," and then the split core would have to be collapsed, in order to permit the finished article to be removed with safety and ease.

Obviously, coring provisions of the character would involve a much greater amount of work when manufacturing the tool, and, in addition, its subsequent operation would be considerably slowed down in speed, so that the ultimate production rate of finished moulded articles would be appreciably diminished, with resultant increase in the unit cost of moulding.

Other troubles would also almost certainly arise after such a mould had been in use for a period, due to the wear or misalignment of the split portions of the core forming the female shape of the component. As a result of such wear, etc., flashings would be formed on the internal walls of the part; if these were of any magnitude their removal would be somewhat difficult, due to their location deep down within the article.

If the splits of the core member were to be reassembled out of line, due to distorted or worn dowels, or to the presence of dirt between the matching faces, additional flash would be caused on the sides of the article.

In the case of a component of this design form required in a thermoplastic material and requiring moulding by the injection method, similar difficulties would be encountered. A split or collapsible type of core would have to be employed, or alternatively the recess could be omitted altogether from the molding process and left for machining at a subsequent operation..

The sectioned design shown at B (Fig. 1) depicts one simple way in which these difficulties may be overcome so that the undercut portion could be formed without introducing very expensive and complicated modifications to the mould construction. From this illustration it will be observed that the internal opening in the component is continued clean through the base wall.

Two mould cores would be required for this purpose. The whole of the cavity formation would be contained within one mould block, and in the base of this cavity a fixed core plug would be mounted to form the two recesses, "d" and "e" respectively. The latter recess would be made slightly larger than the former, to produce a square step or shoulder at the junction of the two features.

Another core plug would be carried in the mating mold block to form the main portion of the internal opening extending to the upper edge of the first recess "d." Both cores would have to be closely fitted for sealing at this point.

The dimensions of the bottom recess "e" would have to be controlled within reasonably close limits of variation, in order to allow a simple moulded disc or plate (in the same material) to be press-fitted tightly into the recess after the main component had been moulded.

The provision of such a simple disc would present no serious or costly toolmaking problems, and the costs involved in producing such a part, even in a separate mould, would in all probability prove far less than the cost of manufacturing a complex mold employing split cores, etc., after the fashion already described.

By this simple adaption of the original design form at A, tooling costs would be kept at a minimum, the shape of the component would be retained substantially as desired, and the speed of production would be maintained at a reasonable level, especially in the case of an injection molded article.

The diagram depicted at C indicates yet another very common design form often encountered in respect of moldings required for industrial purposes. From this sectioned sketch it will be observed that the upper edges of the component lying on the parting-line "a—a" are extended inwards towards each other for a certain distance in order to produce a narrowed opening as shown at "b." By this means lips or ledges are provided on the part, against which a cover plate or lid may be affixed to the box component.

The width across the opening "b," it should be noted, is much less than the distance "c" of the lower portion of the opening, thereby creating a substantial undercut around the inside of the part. Reproduction of such an undercut would give rise to certain difficulties and objectionable features for the designer.

To reproduce such a shape satisfactorily a split core plug would be required with either a compression or injection mold, and the same objections noted in respect of the component shown at A would be associated with such a tool.

A fourth design D (Fig. 1) depicts a far more economical and preferable way in which the component could be re-designed in order to retain the ledge extensions.

As will be seen with this altered design form the internal opening in the article is left perfectly free from any undercuts simply by locating the ledges on the external sides of the part. This will permit the use of a solid-type single-piece core plug for the formation of the entire internal shape of the part, and the mold would again be parted along the line "a—a," as with the previous examples.

The cavity would be contained wholly within one mold block, and the portions required for the reproduction of the ledge extensions all round the exterior would be easily machined directly into the parting-line surface of the block containing the cavity.

The overall width of the component would, of course, be increased by the disposition of the ledges externally, but in most cases this would offer no insuperable objections to a user, especially when contrasted with the undoubted economies obtainable in respect for initial mold cost, and more simplified usage of the tool.

The section E (Fig. 1) illustrates a rather more intricate component configuration which possesses certain interesting features of design. Once again this component is a hollow con-

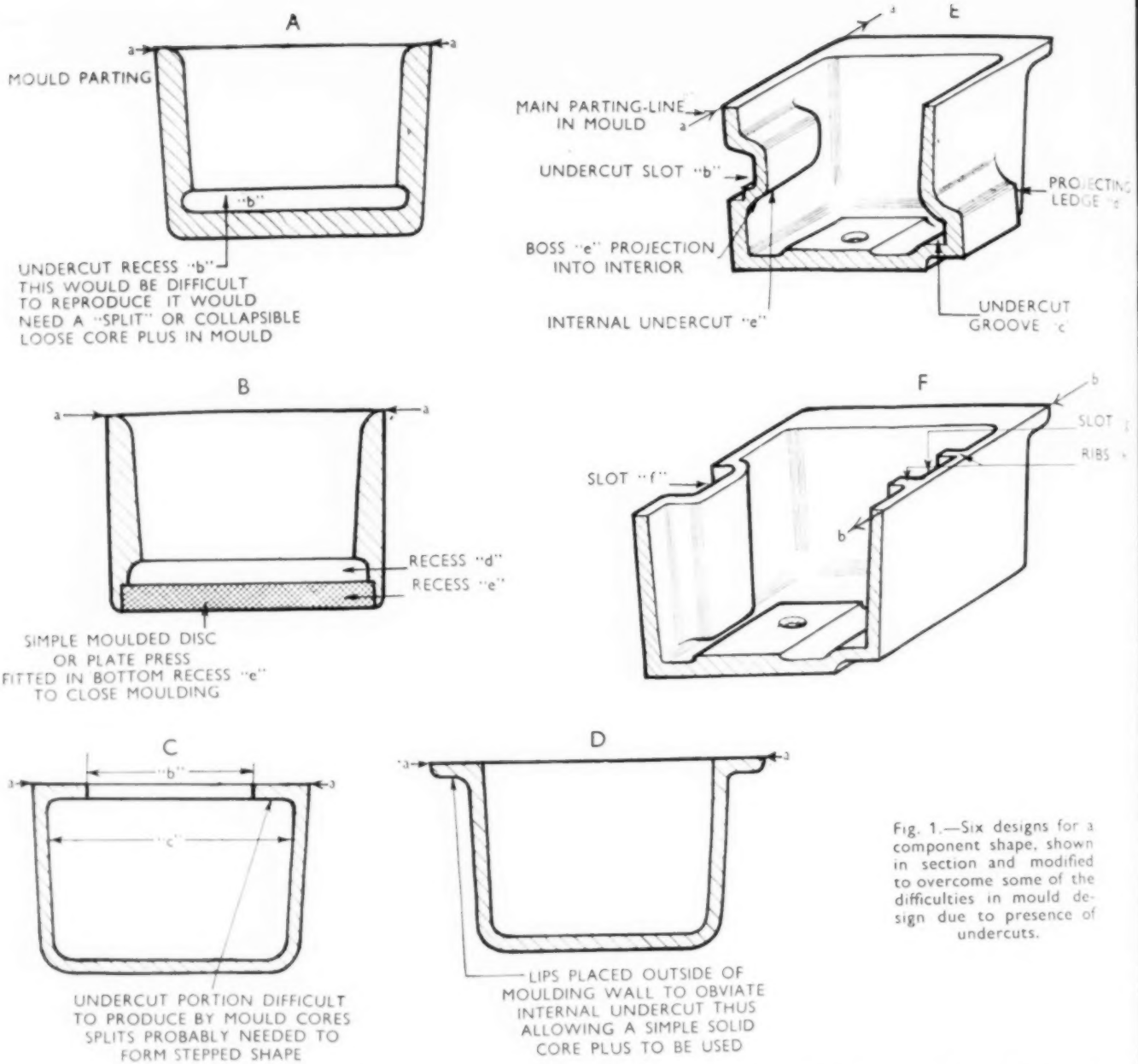


Fig. 1.—Six designs for a component shape, shown in section and modified to overcome some of the difficulties in mould design due to presence of undercuts.

tainer to be produced from a mold, preferably to be parted along the straight top surface "a—a," as shown.

In the left-hand side vertical wall there has to be a depression slot or undercut, as at "b." The base of the right-hand wall is provided with an extension or projecting ledge "d" the introduction of which is necessary in order to build up sufficient wall thickness around the undercut groove "c" formed internally in the part.

On the floor of the component a raised seating has to be provided, this portion having a cored hole clean through. The axis of this cored hole is truly perpendicular to the parting-line surface "a—a."

It will be specially noted that these requirements entail the formation of three awkwardly situated undercuts on the inside walls of the component. Reproduction of these would present certain difficulties when coring the mold. With either a compression or an injection mold a split-type core would be necessary. Furthermore, it may be found during actual molding, that considerable troubles would arise in regard to the contraction of the part upon cooling. Owing to the shape, such contraction would be unequalized resulting in the distortion of side walls or base.

The design shown at F illustrates the manner in which the original design form (E) may be modified to eliminate the afore-mentioned mold construction and operation difficulties, by the complete removal of the offending undercuts "b," "c" and "e."

Referring to this latter illustration it will be observed that the left-hand vertical wall has been altered so as to produce a slot "f." This slot extends throughout the full height of the side as shown, and it will be formed by a simple integral projection left on the side of the female portion of the cavity in the bottom block. The male core plug carried in the top block would be similarly hollowed out to give the requisite wall thickness around the slot.

The right-hand vertical side wall of the component is left perfectly straight, thus eliminating altogether the raised projection ledge "d." On the inside surface of this wall a slot "g" is provided by the introduction of a pair of ribs "h." These members extend from the parting-line surface "a—a" down the base of the component, thus providing a recess down the inside of the part to give a comparable recess with that required in the original design depicted at E.

These portions are capable of being reproduced very simply by cutting

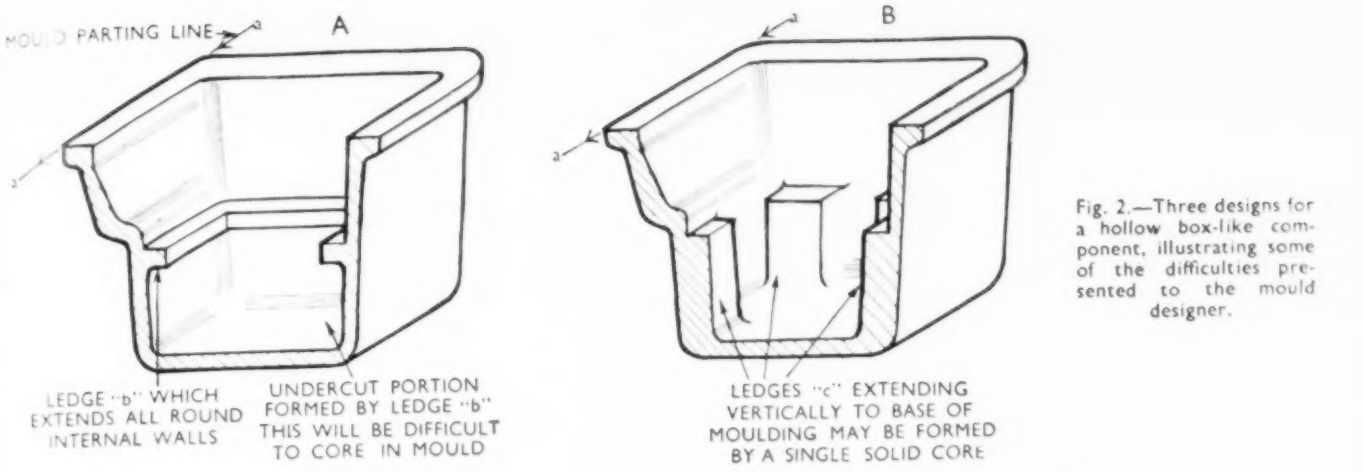

MOULD PARTING LINE
a
A
a
LEDGE "b" WHICH EXTENDS ALL ROUND INTERNAL WALLS
UNDERCUT PORTION FORMED BY LEDGE "b" THIS WILL BE DIFFICULT TO CORE IN MOULD
B
a
LEDGES "c" EXTENDING VERTICALLY TO BASE OF MOULDING MAY BE FORMED BY A SINGLE SOLID CORE

Fig. 2.—Three designs for a hollow box-like component, illustrating some of the difficulties presented to the mould designer.

two slots vertically into the side of the male core plug housed in the upper block. The width of such slots would be equivalent to the width of rib desired. The seating and hole formed on the inside floor of the container will, of course, be readily formed by a recess and small core pin located on the endface of the core plug in the upper block.

These modifications ensure a much simpler design form, which will be reflected in a less complicated type of mold construction, and, of course, increased rate of output of the components. Less troubles are likely to arise in respect of shrinkage pressures and distortion of the walls of the article.

The three designs given at Fig. 2 illustrate yet another very common component requirement which may sometimes offer difficulties to the mold designer. It is a type worthy of brief mention at this stage, before leaving the subject of undercuts.

The first illustration (A) gives a sectioned opened view of a hollow-box component. Half-way down the inside walls there has to be provided a short ledge extension as at "b," extending all the way round the inside as indicated. Such a ledge will create a substantial undercutting of the inside shape, which again, for the reason already noted in respect of the preceding examples, will cause increased complication of the mold construction.

A much more preferable design form is shown at B (Fig. 2). Instead of a continuous ledge running all round the inside walls, however, a series of ledges or bosses of the kind shown at "c" are employed. These are more or less equally disposed along each wall, four of these portions being shown in the diagram. Each boss is extended right to the internal floor of the molding in the manner depicted.

The important feature to be noted in respect of these provisions is that all the bosses can be readily formed from a solid single-piece core plug carried in the upper mold block. The sides of this core would be recessed out at the required locations, and for a sufficient depth and width to produce the boss projections. A finished component could then be readily drawn off the core at right-angles to the parting-line "a—a" to ensure very simple operation of the tool.

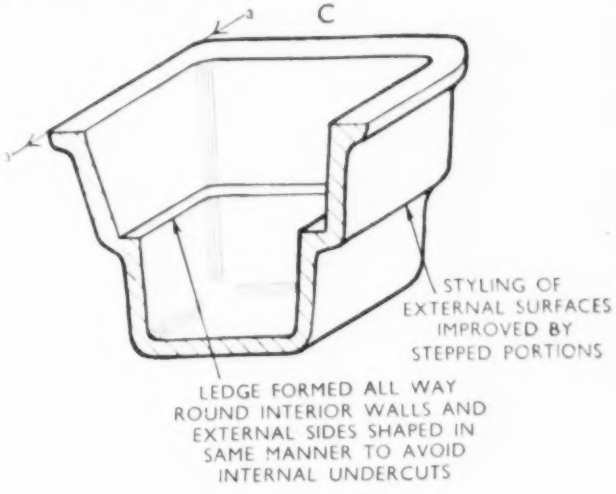
One drawback with this adaption, however, is that it results in a substantial thickening up of the side walls across the points where these bosses are situated, and the attendant troubles previously mentioned might accrue. If these bosses, however, were only to be required for the location of another member, and were not subjected to any great stressing or loading, they would have sufficient strength and rigidity.

The design shown at C (Fig. 2) is perhaps the best and most economical adaption capable of being made to the original design.

With this design form it will be noted that the inside opening has been shaped to produce a square step internally in the part. The opening below this step is continued to the base at substantially the same dimension in regard to width, allowance being made for the necessary core withdrawal draft, of course.

The external walls are similarly shaped to follow the internal contours in the manner illustrated. The design results in a certain economy of material, whilst the large, flat external surfaces on the walls are broken by a rounded step whose effect is to improve the general styling and appearance of the component.

The internal shape may be produced easily from a single solid core plug, as with the example given at B. This is a most economical and satisfactory design form and is one likely to lead to the least degree of operating trouble, or control over the sizes of the finished part.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STYLING OF EXTERNAL SURFACES IMPROVED BY STEPPED PORTIONS
LEDGE FORMED ALL WAY ROUND INTERIOR WALLS AND EXTERNAL SIDES SHAPED IN SAME MANNER TO AVOID INTERNAL UNDERCUTS

These examples will afford useful guidance to component-designers as to the nature of the problems arising from the injudicious introduction of undercut portions on either the inside or outside walls of a component. Very often sufficient latitude can be given respecting the modification of the internal and external shape to avoid use of such undesirable features, along lines similar to those suggested and illustrated here.

It is vitally important always to bear in mind the necessity to select those forms which do not obstruct the extraction of cores. Those shapes and forms are to be preferred which do not involve splits or collapsible-type core plugs for their reproduction, thereby promoting greater simplification of mold construction, reduced costs for such tools, and simpler operation of the mold to give increased production service.

(Published by permission of the English magazine "Plastics")

SPE PRIZE PAPER CONTEST
SEE STORY ON BACK COVER

AROUND THE WORLD

With this issue the SPE Journal begins "Plastics Around the World" which will present selected abstracts from the foreign magazines. Abstracts are made of atricles published in the U.S. only when they are found outside the purely plastics publications.

AUSTRALIA

Abstracter: Albert Lightbody

Australian Plastics, Vol. 8, No. 80, March 1952.

The All-Plastic Skeleton: Staff Article

An English firm has established a full-time business making and marketing skeletons and other osteological models, primarily for medical schools.

Thermoplastic Extrusion: E. G. Fisher

Part II of an abstract of a lecture gives a very general discussion of the take-off systems in use for handling of thermoplastic extrusions.

Hydraulic Maintenance In Injection Moulding Plants: A. R. Morse

Failures in the hydraulic equipment associated with injection molding are analyzed with suggestions for improvements.

Embedding Specimens In Cast Acrylic Resin: R. B. Morrow

Similar to other articles on the same subject but very detailed.

Australian Plastics, Vol. 8, No. 81, April 1952.

Molding of Thermosets In Sweden: Ingemar Salevid.

The progress and growth of the thermosetting plastics industry in Sweden is cited. The only important thermosets in Sweden are phenolics, ureas and melamines. The phenolics as manufactured in Sweden tend to have long curing times and impaired general properties. The domestic ureas and melamines are of high quality. The equipment used in Sweden are for the most part compression presses with a central hydraulic system and using electricity as the heating medium.

This article appeared in the SPE Journal for Dec. 1951.

Manufacturing Possibilities for Polymers of Acenaphthylene: W. S. Penn

Low cost polymers of acenaphthylene and copolymers with other unsaturated monomers are coming into prominence. Work carried out at the Chemical Research Laboratory and Powell Duffryn Research Laboratories, Ltd. in England have demonstrated excellent potentialities of production of acenaphthylene from coal tar. Subsequent polymerization yields materials with a high softening point (300°C), good electrical properties but rather brittle. Plasticization is possible with many types of plasticizers. Greater possibilities exist with copolymerization with materials such as styrene, vinyl acetate, butadiene, etc. The cost figures are so attractive that some of the present defects may be overlooked if not overcome.

Plastics in the Metalworking Industry: Staff Article

The use of resins in bonding abrasives, in thin shell foundry molds, in parting boards, in patterns from cast phenolic resin, in investment castings and in forming dies and drill jigs is shown with emphasis on the exact process. Advantages of the plastics devices over previously used methods are pointed out.

FRANCE

Abstracter: Hans Mayer

Industrie Des Plastiques Modernes, Vol. 4, No. 6

Chimie Et Applications Industrielles Des Resines "EPICOTE," M. R. Martin.

Discussion of the nature, possible modifications, and uses in the plastics industry of a resin composed of polyalcohol and epichlorhydrine.

La "Maison Plastique": Jean Delorme

Description of the possible use of plastics in the architectural structure of a modern home with particular reference to floor covering, wall covering and decoration, application of tiles, windows, and lighting effects.

Engrenages Legers En Matieres Plastiques: J. Tavernier

A discussion of the use of plastic silent gears in clock and calculating machine work and an analysis of the advantage of their use compared to metal gears.

La Mesure Des Epaisseurs par le rayonβ: John Delmonte

The description of a method to determine the structural soundness of plastic bodies by the employment of radio active substances, a comparison of the effect of X rays, beta rays, and alpha rays and a suggestion for the use of isotopes and the development of the proper apparatus.

Quelques considerations sur les machines a injection: R. Colin

A description of the construction of injection machine cylinders and pre-plasticizers as seen by the writer on a number of European and American Injection Machine models.

Industrie des Plastiques Modernes, Vol. 4, No. 7

Ideas on the Subject of Injection Machines: R. Colin

This article discusses the provisions for satisfactory clamping pressure as developed over a period of time, starting from single ram transfer type molding and discussing mechanical, toggle type, and straight hydraulic devices to keep the die closed during the injection stroke.

How to Combine Articles Molded from Polystyrene: G. Fabre

A detailed discussion of solvents, monomers, and techniques for the purpose of obtaining a jointless bond in the assembly of a number of Polystyrene moldings into a single object.

The Extrusion of Polystyrene: W. C. Goggin and McDonald, Jr.

A translation of the article in the Sept. '51 issue of the S.P.E. Journal.

Fiberglass In the Service of Plastics: M. Duclos

Discussion of the use of glass fibres in combination with plastics and an appraisal of results obtainable. It seems that the experience with glass reinforced moldings is in its infancy and later developments in the USA like the glass filled alkyd molding compound are not even mentioned.

Bibliographie—page 53

Announcement of an English-French Chemical Dictionary by R. Cornubert, published this year by Dunod.

This dictionary does not limit itself strictly to chemistry but covers the field of physics as well.

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GERMANY

Kunststoffe

Abstracter: Anne Schwend

The June issue of the "Kunststoffe" magazine contains articles on the following subjects:

"Modern Plastics—an illustration of its manifold chemical synthesis" by Dr. K. Hultzsch, an excerpt from an address held in Vienna in September 1951. To an ever increasing extent the results of organic chemistry are being called upon in order to find new ways of reaction, to combine the latter among each other, to even exchange basic structural elements, thus promoting the assortment of synthetic high polymer compounds. The article characterizes today's trend of development and the wide variety of the newer products such as polyamides, silicones, polyurethanes and polyurea resins, thermoplastics and caoutchouc-elastic materials on the basis of pure and modified polyesters, non-saturated polyesters, styrolized alkyd resins, aethoxyline or epoxyde resins recently developed in Switzerland, polyethylenimin resins, polyether-cycloacetals, xylol-formaldehydes, phenol- and aminoplasts, phenolic acetylene resins.

"Fibre Plates and Fibre Chip Plates" by Dr. R. E. Vogel. The technique of producing fibre plates from wood pulp and bonding cement or wood chips and phenolic resins is discussed. Bonding, hardening and impregnating methods are described as well as strength characteristics obtainable. The author of the article comes to the conclusion that the development of fibre plates has not yet come to a standstill. The possibility of imitating natural wood and grained plywood, artificial leather plates as well as plastic coated plates will mean new large markets for this industry.

Dr. August Hoechtlen of Leverkusen gives an outlook on the 1952 Convention of the German Plastics Industry which is to be held at Duesseldorf from October 13th to 16th. The program will be so composed as to dedicate one day to speeches on chemical developments, the next day to physico-chemical developments and the last two days to addresses on new techniques and technologies. This convention shall not only present an opportunity for information on new developments abroad, but to an increasing extent shall make acquainted with the results of research work done in the plastics field in Germany.

Mr. Franz Berger of Troisdorf, in an article sums up the principles for welding rigid polyvinylchloride and describes the various methods for different welding seams.

Dr. Escales, in an article on "Correct Cooling Down of Extruded Parts," especially in the cable industry, comes to the conclusion that sudden chilling is often the reason for breaking and the failure of extruded parts when exposed again to higher temperatures than normal. It is, hence, advisable to watch the freezing point of the plastics materials used, i.e. the point where strain and tension within the material will be perpetuated through chilling or released through renewed exposure to heat. Therefore, prior to cooling from working temperature down to room temperature some time should elapse so that any strain caused through processing may re-adjust itself and thus not be fixed permanently to the disadvantage of the product in question. Since it is not only a question of cooling the outer sections of the product but just the same the core, it would be best to use a good heat conductor which can be kept at a constant temperature slightly above the freezing point of the material at very little expense. Same will bring about an equalization of warmth. Vats with warm water kept at the same steady temperature will very well serve as medium. After the extruded material has passed these, it will quickly dry and cool down below the freezing point on the take-up mechanism and can then be rolled, cut or piled up without having to fear any inner tension or outer deformation.

Dr. Lisa Roessig reports about "Testing Methods for the Definition of the Speed with which Plasticizers Wander." Two testing methods were developed. For test No. 1 plasticized PVC plates were placed between hard-PVC-plates (which must be free of any plasticizers) and stored at 65% relative humidity and at various temperatures in the drying chamber. After a certain time the plates were cut into layers of 10 to 20 u thickness and investigated for their density by means of an acqueous zinc chloride solution. The second testing method avoids the skill-requiring cutting of thin film from PVC plates treated as above and provides that layers of 10 to 20 u be cut from hard-PVC from the very beginning. Plasticized PVC plates will be packed between each ten of these layers. Results will show much more quickly than by method No. 1. It can already visually be stated whether plasticizer has been absorbed since the hard-PVC layers will increase in size and show a crimped surface. Another test where PVC plates were plasticized with Mesamoll and dibutylphthalate respectively and dyed with Sudan red showed that the test with Mesamoll did not produce any noticeable color transfer, while the dibutyphthalate test very clearly showed a color effect. This observation shall be used for further tests for the definition of the quantitative transfer of plasticizers.

A new apparatus produced by Messrs. Frieseke & Hoepfner GmbH. of Erlangen-Bruck for the measuring of the thickness of sheets and ribbons without touching the materials is described. This apparatus works with B-rays whose absorption depends on the superficial weight of the plastic material to be tested, independent of kind of material or composition.

Engineer Heinz Jungnickel makes suggestions for the determination of tensile strength and elongation at rupture for tubes and plates made of hard PVC. He describes at length how to take testing rods, how to prepare, mark and test them and evaluate the results. These suggestions are meant as a contribution for the standard-

ization of testing methods which is about to be prepared by the German Standards Committee.

Dr. Otto Umminger has developed an apparatus for measuring the adhesive power which permits to determine so-called "blocking" of two plastic sheets in grams per square centimeter. This apparatus works on the same principles as a torsion balance and consists of two parts: torsion balance and clamping device for the sheets to be tested. The plastic material to be tested may be stored, folded together, for various lengths of time and exposed to different pressure and temperatures. Results have shown a deviation of 4% from the medium value when testing each six samples from the same sheet of material that had been tested under the same outer conditions. This result should be entirely satisfactory for stating the adhesive power of plastic sheets.

The German Standards Committee publishes the draft for a new standard on "Refractometric Determination of Plastic Materials." Determination of the refractive index of plastic materials will often render superfluous circumstantial analysis, since the refractive index will give a lot of information on the composition of the material. Measuring shall be undertaken by means of an "Abbe" refractometer with prisms which may be heated or cooled and with which the refractive index may be measured either at transmitting or reflected light without changing the device. An ultrathermostat shall be used for tempering the prisms, a sodium lamp as light source. Further, excellent contact between material to be tested and prism has to be established by using "contact means" having a higher refractive index than the plastic material to be investigated and which may neither be absorbed by the plastic sample nor may they plasticize or dissolve same. Different contact means are listed for the various plastic materials. Preparation and fixing of the samples on the prisms are minutely described. Measuring shall take place at 20° C (68°F) plus or minus 0.5°C and only when temperature has settled down to constancy, i.e. at the earliest ten minutes after fixing the plastic material between the prisms. The light source and screen shall be so adjusted as to establish high contrasts when fixing the half-shadow-limit. Each sample shall be measured five times, thereby moving the sample on the prism. The limit for measuring incorrections with the "Abbe" refractometer hereby amounts to one to two units in the fourth decimal. Should there result greater differences than five units in the fourth decimal for the refractive index, this will prove that the plastic sample is subject to strain double refraction or inhomogenity. Such results would have to be pointed out in the report about the test. Further, this standard draft enumerates the data to be shown in each test report.

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GREAT BRITAIN

Plastics Inst. Trans., London, Vol. 20, No. 40, p. 29 (1952)

Abstracter: Harriman H. Dash

A Method of Testing for Cure In Aminoplastic Mouldings: C. P. Vale

The standard boiling water or acid tests for urea and melamine resins, while sufficient to distinguish between cured and uncured states of the molded resins, were not found sensitive enough to follow the various stages of curing. Dye staining was found to be a satisfactory method for demarcation of cure as compared to water absorption. Details of the dye staining technique for colored as well as uncolored ureas and melamines are given in the text. These methods have been successfully employed in studying the effects of pelleting and preheating, and in determining the cause of uneven cure. The value of these methods was aptly demonstrated by the proof that a 10°F difference between upper and lower platens eliminated uneven cures. This paper should be of vital interest to molders of aminoplastic tablewares.

Some Aspects of Cast Resins: M. Apley

The paper deals mostly with phenolic resins, though some brief discussion of the newer casting materials (polyesters, aminoplastics, methacrylates, styrenepolymers) is also given. A. has presented a very informative account of the development and production of the phenolic cast resins. Many important factors such as optimum F/P ratio, pH, moisture content, droplet size, are discussed in detail. A brief theoretical review of the chemistry involved in the thermosetting process for the phenolics is presented. Many applications, including some of the more recent ones (tooling, photoelastic stress analysis, post-forming) are ably discussed. A careful distinction is made between cast phenolic resin (slow heat cures) and the newer types of phenolic casting resins supplied as low viscosity liquids subject to rapid cures by addition of catalysts. The latter are not as versatile as the competitive addition type polymer casting resins unsaturated (polyesters, allyl phthalates, epoxy).

The Fabrication of Laminated Materials: N. W. Sabin

A brief discussion is presented of the economies of fabrication as compared to moulding. The advantages of the former in small lot production is undisputed, but fabrication also has its quantity demand in applications for which laminated plastics are ideal. This is followed by a description of the various machining operations employed in the fabrication of laminated plastics. The text is limited to paper and fabric base laminates. Readers will find the section on post forming most interesting. A lively question and answer section of various shop details follows the text.

British Plastics Vol. 25 No. 277

Abstracted by Herbert H. Simonds

Editorial

New products follow trend toward wider industrial application rather than toward popular consumption. The user industries are often quicker in recognition of plastics potentialities than the plastics producer industries. An example is the growing application of glass fiber reinforced plastics, largely the result of user ingenuity.

Papers of a recent convention organized by glass manufacturers are summarized in the present issue.

Pictorial Report

This shows some forty new products among which the following appear most important to American plastic interests.

- Large injection molded acrylic lampshade
- Phenolic spinnerette for casein spinning
- Polystyrene battery box and cover
- Polyethylene radar mast component
- Acrylic oxygen tent
- Polyethylene container for dangerous chemicals
- Golf bag of fabric woven with extruded vinyl monofilament
- Foundry molds of a mixture of sand and phenolic powder
- Film reel of phenolic laminate
- Melamine airplane food dishes
- Polystyrene egg carton
- Phenolic heavy duty electric relay with polystyrene case
- Molded nylon motor-car door mechanism

Plant and Equipment

At the British Industries Fair many standard and new tools of the British plastics industry were shown. These in general are similar to their American counterpart although usually smaller in size and capacity.

A few examples will serve to illustrate the nature of the exhibit:

A new horizontal hydraulic pelletizing press by B.I.P. Engineering, Ltd.

A new injection machine, capacity 1 oz. with 420 shots an hour claimed. Manufacturer: R. H. Windsor, Ltd.

A ¾ oz., foot-operated injection machine which leaves operators' hands

free for other duties. Three-hundred shots a minute claimed. Manufacturer: Davidsons Engineers (M C) Ltd.

A fully automatic 50 ton Lancastrian press was shown in operation on electric components.

A multi-screw extrusion machine with a capacity of 100 lb. per hr. set up for production of unplasticized polyvinyl chloride piping.

A new plastics welder has capacity for welds or seals up to 10 feet in length. Feature is double stage cycle giving reduced voltage at start to lessen danger of sparking. Manufacturer: Radio-Heaters, Ltd.

Standards for Electrical Moldings

Work on standardizing procedure has caused the production of new and improved facilities for measuring and testing electrical equipment. Plastics components for electrical accessories may be made by the manufacturer or by a custom molder. But in either case there are two possible hazards. One is in selection of molding powder and the other in scheduling production procedure. Obviously it is important to establish means for readily recognizing substandard products. In doing so, it is well to overlook properties of the formless powder and concentrate on the character of material in the molded article.

In studying such character, it is convenient to group properties under the six headings shown in Table 1.

Standard tests and test specimens have been adopted for all the important properties shown in Table 1.

In any one case there may be three steps:

1. Determine minimum requirements
2. Comparison of such minimum requirements with known properties of materials
3. Make destructive tests on prototypes.

Manufacturers specifications appear well established for phenolics, polystyrene and cellulose acetate. In addition there are informative booklets available giving particulars of each material.

It should be kept in mind that it is not the specific properties of a material that determine results, so much as the use made of the material by the designer and the fabricator.

Above abstracted from acticle by: W. D. Owen, Electrical Research Assoc., London, W. C. 2

A New Urea Plant

In 1950 the United Kingdom production of urea resin was 46,000,000 pounds, a 33⅓% increase over the previous year. The 1950 production figure for urea molding material also showed a similar increase to 28,000,000 pounds. The 1951 export shipments of urea molding material totalled 8,960,000 pounds compared with 6,360,000 in 1950.

All of this brings importance to the recently finished urea formaldehyde plant of James Ferguson & Sons, Ltd. in London.

In this company's previous plants, urea molding material was made much after the method used for phenolics. In the new plant the liquid resin is mixed with woodflour in stainless steel internal mixers and is then dried to desired moisture content in a continuous dryer. From the dryer the material issues as a cake which is ground to a fine mesh and stored in cyclone hoppers. Mixing of ingredients is done on a pair of 60 inch heated rolls which revolve toward each other at different speeds. Material is taken from the rolls in a sheet about 6 inches wide which passes through an 80 foot cooling conveyor. It is then ground and fed into drums.

Transfer Molding of Commutators

Nelco, Ltd. of Shalford, England, is producing 8000 transfer molded commutators each week. These range between ½ inch and 2 inches in diameter. A feature of their design is the use of mica or Micanite inter-segment insulating strips which keep the outer edges of the copper segments free of molding powder and thus prevent tracking. Because of this a medium shock resistant phenolic is used instead of high grade electrical powder.

In most cases Micanite sheets — 0.020 to 0.021 inches thick — are stamp cut into separators slightly larger than the copper. Both sides of the sheets are dyed blue so that any flaking during stamping can be easily detected.

Assemblies are made up on appropriate presses and jigs and are stored ready for the transfer molding.

A five ram press of special design is used. Each assembly to be molded is placed on a center pin.

Honeycomb Structures

Gordon May in collaboration with Dufay-Chromex, Ltd., has developed a new low-density material, said to possess the highest strength weight ratio of any commercial material. It combines all-wood craft paper and phenolic resin in honeycomb form and is now available in England in weights from 15 to 30 oz. cu. ft.

Many new applications are described by Mr. May, including a one piece chair where the elasticity of the material forms a slight spring action. Other applications include a container for air transport, bus roofs, berth construction in trailer vehicles. In the furniture trade the most common application is in the construction of flush type doors. One complete schoolhouse has been constructed of this new honeycomb material. In Britain the requirements of the aircraft industry bring these new light weight materials into greater prominence. It is stated that a saving in weight of a few ounces in construction of an airplane would account for an annual operating saving of a few pounds sterling.

Above abstracted from article by: Mr. George May, Consultant to Dufay-Chromex, Ltd.

Glass Reinforced Plastics

This is a summary of papers presented at a recent convention of fiberglass users and manufacturers. Among the papers presented was one by Dr. V. E. Yarsley, who described the many different types of polyester resins. He spoke of the recent variation in contact resins, stating, "The polycarboxylic acid used may be saturated, e.g., succinic, adipic, or phthalic; or unsaturated, such as maleic, itaconic, or methacrylic. Similarly the polyhydric alcohol may also be a saturated compound such as glycol or diethylene glycol, or unsaturated, viz., allyl alcohol. In addition there is a choice of crosslinking agents —the commonest are styrene, methyl methacrylate, and vinyl acetate. The number of possible compounds from even these examples are numerous,

TABLE I

Properties of Materials

Physical	Mechanical	Electrical
(a) Specific gravity	(a) Tensile strength	(a) Electric strength (puncture)
(b) Hardness	(b) Resistance to compression	(b) Flashover
(c) Porosity (water absorption)	(c) Transverse resistance	(c) Volume resistivity
	(d) Impact strength	(d) Surface resistivity
	(e) Machinability	(e) Power factor
		(f) Permitivity

Thermal	Chemical	Optical
(a) Plastic yield	(a) Resistance to reagents	(a) Light transmission (transparency)
(b) Thermal conductivity	(b) Effect upon oil	(b) Haze (light scatter)
(c) Thermal expansion	(c) Ageing characteristics	(c) Refractive index
(d) Heat resistance		(d) Spectrum of light passed.

although not all are practicable propositions."

Another paper by A. M. Dobson (Fiberglass Ltd.) gave details of construction materials used in fiberglass reinforcements. It was pointed out that fibers must be sized to aid in handling and weaving, but that for best results in plastics laminates, this sizing should be removed. Three methods were given. The first, known as caramelization, leaves the material brown. The second, "full heat" treatment using higher temperatures, leaves the material white but more fragile than the caramelization method. The third, washing with suitable detergents, is not considered too satisfactory.

Other papers presented were by H. Cole (Pilkington Brothers, Ltd.), H. Warburton Hall, and G. A. Collie (Ministry of Supply), K. Hyde (Ashdowns, Ltd.) and G. C. Hulbert (Bristol Aeroplane Co., Ltd.)

Platen Heating

This article describes heating by mains frequency induction, stating that a full range of platens using this method is now available in England. Mains frequency induction heating has several advantages over the high frequency method. With this method, heat is generated through the action of eddy currents set up in the platen by means of built-in induction coils. Thus the heat is created in the metal of the platen itself and not by conduction. The principle of induction heating is also applied to extrusion machines where the advantage would be even greater than with heating platens.

It seems likely that there may be a greater future in extruder design than in the field of compression molding and general press work.

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HOLLAND

Abstracter: W. P. terHorst

Plastica Vol. 5, No. 6.

Application of Hard Polyvinylchloride: W. L. Essed

Vinidur, (hard polyvinylchloride) is suitable as a corrosion resistant lining. Chemical resistance to acids, alkalis, hydrogen peroxide is in general good, but limited in contact with chlorsulfonic acid, hydrofluoric acid, moist chlorine, carbon tetrachloride and carbonbisulphide. Vinidur does not resist acetone, ether and esters.

Review of the Presently Known All Synthetic Fibers:

A sketchy description of the properties and composition of the American synthetic fibers: Acrylan, Dacron, Nylon, Orlon, Avisco P E, Dynel, G E-fiber, P E-fiber, P F-fiber, Polythene, Reevon, Saran, Velon, Vinyon-V, Vinyon N and Wynene.

Filtercloths, Woven From Polyvinylchloride Yarns

The advantages of "Duracal" filtercloth are: resistance to acids and alkalis, water repellent, rotproof, noninflammable, quick loosening of the filter cake, quick drying.

Plastic Chains

Abroad there is considerable interest in plastic chains made in Holland from Bakelite or urea-formaldehyde resins.

The novely is that, contrary to past practice, the links do not consist of two halves that are glued together, but the entire chain is pressed in one piece, resulting in higher strength and better resistance to humidity and weathering.

Use: insulators for portable army antennas.

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MEXICO

Abstracter: John B. Ballard

Mexican Rubber and Plastics, Vol. XII, No. 75, April 1952

Designs for Plastic Sheets, Rods, and Tubes: R. L. Davis and R. D. Beck

Fundamental design considerations for products to be fabricated from plastic materials.

The Application of Titanium Pigments in Rubber and Plastic Compounds: Joseph Breckley

The chemistry of titanium and titanium dioxide pigments, and their use in rubber and in vinyl plastics.

Mexican Rubber and Plastics, Vol. XII, No. 76, May, 1952

Economy In the Manufacture of Plastic Products: R. L. Davis and R. D. Beck

A basic discussion of the economies governing decisions whether to make products out of plastic materials and what equipment and methods to use.

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SWEDEN

Abstracter: Walter E. Weber

Swedish Information Bulletin of the Swedish Plastics Association. (Plasttoerningen Meddelar) Vol. 7, No. 20, May, 1952

Some Properties and Present and Potential Uses of High Acetyl Cellulose Acetate: Dr. J. G. Davoud, Courtaulds Ltd., England

The European Plastic Industry which has been looking for raw material combining high dimensional stability and water resistance with the toughness of cellulose acetate had to turn, since the war, to the United States for ethyl cellulose and cellulose acetate butyrate molding powders. An English manufacturer, Courtaulds Ltd., has now started to manufacture two types of high acetyl products which are said to be very superior to regular acetate. A series of tests has proven the superiority convincingly. Especially noted is the freedom from surface crazing found in the water resistant grade as well as a general improvement in dimensional stability. The 56% actyl value as against 54% in regular acetate is suggested for pen parts, and control knobs, hair brushes, etc. Grade WR, 57½% to 58% is suitable for industrial purposes under the most rigid conditions. Suggested applications are motor housing, can accessories, telephone outings, covers and also parts for the textile industry such as bobbins, etc.

Polyamid Manufacture In Soviet Russia

The manufacture of the Polyamid fiber of the type Perlon is said to have made progress in 1950 in the Soviet Union. Hose made of that fiber sells under the name of Kapron. A west German delegate to the World Economic Conference in Moscow testified that these hose were of first class quality. The price range in different qualities in the Moscow stores varies from 27 to 40 rubel per pair (approximately 37 to 52 Swedish Kronr=$6.50 to $10.00 in United States dollars). The output is said to be 55 million pairs of all synthetic fiber which represents a 35% increase over the 1951 production.

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UNITED STATES

Abstracter: W. W. Birdsmith

Wider Design Opportunities With the New Phenolics, Part I. A. E. Javitz

Electrical Manufacturing, June 1952

A rather complete discussion of the properties, advantages and disadvantages, and design application of the newer phenolic molding resins, including the rubber-phenolics, nylon-fabric filled phenolics, glass-filled phenolics, low-pressure compounds, flame-resistant phenolics, electroplating compounds, bisphenol-derived phenolics, epoxy compounds, substituted-phenol phenolics, furfuralmodified phenolics, and the newer general purpose and special purpose phenolics.

Wider Design Opportunities With the New Phenolics. Part II. A. E. Javitz

Electrical Manufacturing, July 1952

New developments in phenolic lam-

(Continued on Page 27)

TORONTO PANEL DISCUSSION TOPICS ARE MOLD DESIGN, PLASTIC PIPE, CHECKING

J. L. Burnie

This meeting took the form of a panel discussion at which T. J. Carey was moderator and the panel was composed of Messrs. B. Kellam, T. Wold, H. A. W. Lynch and F. McEwen.

The first subject put to the panel, by C. Seay, was what allowance to allow on moulds for shrinkage. The following conclusions were reached:

1. It is not possible to forecast exact shrinkage and where tolerances are close it is necessary to use trial and error and rely mainly on judgment and experience gained on previous jobs.

2. Data supplied by material suppliers, while as accurate as it is possible for them to make it, cannot be relied upon 100% due to shrinkage also being dependent upon the job, machine, and in the case of thermoplastics the location of the gates and type of gating. Figures were given by one moulder which showed a 33% decrease in shrinkage when they changed from conventional gating to pin point moulding.

3. The method of measuring shrinkage has much to do with the results obtained, it should be measured from cold mould to cold piece.

A. Long questioned the panel as to plastic piping and we were advised that at present there are two groups with a budget of $5,000. each, studying the corrosion of underground pipe and conduit. It was pointed out that a 100 foot length of some plastic tubing had a 16" expansion over a temperature range of 100°F. and hence the installation of plastic piping is of utmost importance. At the moment more details are required on the installation including connections, fittings, etc. In this regard it was pointed out that the injection moulders must work very closely with the extruders.

Cold flow was discussed for the various thermoplastics as well as polyesters and it was pointed out that most materials were not satisfactory for water over 100°F. and in far Northern climates PVC is not satisfactory.

It was concluded that plastic piping should first be investigated where present piping is not entirely satisfactory. These end uses would include, irrigation, oil fields, coal mining, jet wells, chemical plants, etc.

The next question advanced by H. Humphries had to do with possible uses for flash from thermosetting moulding.

Melamine and urea flash can be sold for fertilizer, however, phenolic flash has found very little use. There are, or have been, moulders who have worked in about 10% flash with virgin stock, however, one of our members who tried this advised that they found their rejects were increased to such an extent that it was not economically advantageous.

It was learned that it might be possible to use melamine as insulation and any of them may be suitable as packing in a fractional distillation column when for use under reduced pressures.

J. Schneider inquired as to the causes of checking of styrene mouldings after lacquering and aging and possible cures.

It was agreed that checking was due to: (1) solvents in the lacquer and (2) strains in the piece. As the checking referred to in the question was developing prior to the piece being put on the market, stresses and strains caused by improper use were not considered. It was generally agreed that annealing was the best method to release strain caused in the moulding and this also increases the dimensional stability of the piece. As for the checking caused by lacquers was concerned this amounts to the proper selection of lacquers but a lacquer which bites into the material breaks through the outer skin and will thus permit the internal strains to pull and thus cause cracking, annealing would thus help checking caused by lacquering through the removal of these internal strains.

Other causes of checking are improper machining and packing in the mould.

The next question put forward by J. Schneider was how to avoid cracking—after a period of time—in urea mouldings especially when transfer or plunger moulding was used. It was pointed out that urea mouldings, especially when transfer or plunger methods used, are not dimensionally stable and moisture, temperature, etc. affected ureas to a large extent, new materials now under test might help but with present materials transfer and plunger moulding should be avoided. Transfer moulding of thermoplastics were mentioned and it was stated that it amounts to preplasticizing the material. The advantages and disadvantages of preplasticizing were discussed.

The panel was thanked by Mr. L. Koenig after which the meeting adjourned at 10:00 P.M.

Buffalo Hears What Customers Should Know

The Buffalo Section held its annual "Ladies Night" on Friday, May 16, at the Park Lane Restaurant in Buffalo with Mr. Warren H. Goodwin, Associate Editor of Modern Plastics Magazine as the guest speaker. Mr. Goodwin's talk on "What Every Consumer Should Know About Plastics" covered the field of items manufactured directly for consumer use. He emphasized the proper design and proper utilization of the characteristics of the various plastics material. He illustrated his talk with many samples and distributed these samples as door prizes to those with the lucky numbers. This was one of our most successful "Ladies Nights" in every respect.

The June meeting was a joint affair with the Toronto Section at the St. Regis Hotel on Friday, June 20. Mr. Carl Sundberg of Sundberg-

NEWS OF THE SPE SECTIONS AROUND THE NATION

SECTION NEWS

(From page 23)

Ferar, Detroit, Michigan, an outstanding designer and consulting engineer, was the guest speaker. A number of Buffalo Section members made the trip to Toronto to meet with our Toronto associates and to hear Mr. Sundberg.

Vacuum Metallizing Discussed At New York Meeting

A. M. Merrill

A talk on "Vacuum Metallizing" by Sanford S. Zimmerman, F. J. Stokes Machine Co., featured the June 18 dinner meeting of the New York Section, held at the Gotham Hotel. Some 55 members and guests were present at the meeting, the last before the summer recess.

Mr. Zimmerman stated that vacuum metallizing is the deposition of pure metals, alloys, or metal salts on a surface under high vacuum conditions. Surfaces are metallized for both decorative and functional purposes. The object to be metallized and the metal to be deposited are enclosed in a high vacuum chamber, and a high temperature applied to the metal or salt. The metal vaporizes and the vaporized molecules travel from the source in straight lines to deposit themselves on the facing surface.

For decorative purposes aluminum is the most commonly used metal for vacuum metallizing because it is cheap, easily vaporized, and the deposited coating simulates the appearance of platinum, rhodium, or chromium. The coating is extremely thin, being controllable to 0.000001 inch and seldom exceeding 0.000005 inch in thickness. Since the film will reflect any defects in the surface of the part to be coated, the surface is given an undercoating of lacquer which minimizes these defects and, at the same time, minimizes out-guessing of plasticizers during the vacuum operation.

The parts to be metallized are set on racks which are placed in the vacuum chamber. Aluminum, in the form of staples, is hung on coils of tungsten wire filaments connected to a source of current. The chamber is exhausted and the metallizing operation begun when pressure in the chamber has been reduced to 0.5 microns or below. Evaporation or flashing of the filaments takes place when current is passed through the tungsten wire to evaporate the aluminum staples. The metallized parts are given a topcoating of lacquer for protection against abrasion. The topcoating can be dyed to give a bronze, gold, or copper effect to the finished parts.

Parts to be metallized on one side are placed in the vacuum chamber so that the surfaces to be coated face the source. Parts to be coated on all sides are placed on revolving spiders which are driven from outside the chamber. The metallized coating is flexible on cloth, paper, acetate sheeting, and other materials, and webs can be coated by winding from one roll to another during the flashing operation.

The talk was illustrated by slides and samples of parts, and was followed by a lively discussion period during which questions were answered by Mr. Zimmerman and J. Gordon Seiter, also of Stokes.

Section president Bruno E. Wessinger, Wess Plastic Molds, Inc., presided over the business session which preceded the talk. Reports were heard from Richard Thews, Monsanto Chemical Co., on the progress of the education committee which is working with the New York City Board of Education on the setting up of a plastics vocational high school course; and from Stanley Bindman, Jamison Plastics Corp., on his recent appointment as section news editor for the **SPE Journal.** Table favors were distributed through the courtesy of Arthur L. GeWertz, manufacturers representative, and the meeting closed with a drawing for door prizes contributed by King Specialty Co. and won by J. Martyn Voegtlen, Celanese Corp. of America, and J. Steiner, F. J. Stokes Machine Co.

Following the summer, the Section will begin the new season with its annual business meeting and "gripe session" on September 17 at the Gotham Hotel. The meeting will include a cocktail hour and dinner.

Toledo Notes

R. F. Debrock

The Toledo Chapter of SPE held its annual golf tournament at the Chippewa Golf Club on July 2. The tournament started at noon and the day was completed with a dinner in the clubhouse.

Following the banquet, William E. Fillmore, president, conducted a short meeting and then turned over the program to Herb Pioch, master of ceremonies, who had made arrangements for the evenings' entertainment.

Prizes were awarded to the day's various golfers as well as door prizes to the members who attended the banquet.

The next regular business meeting of the Toledo SPE will be held sometime in September, and the date and place will be announced at that time.

Southeast Ohio Visits Ohio Plastic

The Southeastern Ohio Section of the Society of Plastics Engineers held a special summer meeting Tuesday July 29, 1952. As the guests of Mr. George Edwards president of Ohio Plastics Corp., Frazeysburg, Ohio.

After a trip thru the Ohio Plastics plant where each person received several articles manufactured there.

The afternoon was spent at a swimming pool followed by dinner served in the Ohio Plastics club rooms.

A drawing was held for some very fine door prizes furnished by Alan L. Weil of Muehlstein and Co.

The speaker of the evening Miss Lisa Gunkel who's subject was "Count Your Blessing's" the subject was of great interest the speaker a relative newcomer to America, having spent the majority of her life under Nazi domination in Germany she compared the mode of living, teaching and thinking, the participation in the German youth movement, the intense propaganda program, the distrust of the rest of the world and the lack of Democratic principles, which we take for granted. Especially the franchise of voting and selection of nominees for elective office by the people.

A humorous incident of the war was the impression of the German civilians of the American troops, at the time of the American penetration of Germany the girls in her village barred doors and hid in basements expecting full blooded American Indians complete with war paint and full regalia their surprise on seeing our troops "So handsome and so friendly too" the terrific impact of realities a desire to visit the country of our G. I. Ambassadors the dream come true, America! the amazement of our country the buildings, the freedom of travel and exchange of information, the comradeship of our technical and civil organizations.

The meeting was attended by thirty members and guests. A vote of thanks was extended to Mr. George Edwards by the members. The meeting was adjourned by our president Ben Monaco there will be no further meetings until fall.

Buffalo Meetings

October 17, 1952
"High Impact Styrenes & Copolymers"
Paul Elliott
Naugatuck Chemical

November 21, 1952
"Marking of Plastics & Plastic Products"
A. N. Skeels
Roll Leaf Stamping Co.

Silberkraus Abroad

Samuel Silberkraus, past president of the New York section of SPE is taking a six weeks trip through Europe and the middle East, during which he will look into the progress of the plastic industry in these areas. He will also supervise the installation of a molding plant in Iran.

Miami Valley Picnic

John L. Russell

Miami Valley Section held its annual Fall Picnic at Old River Park, Dayton, on Thursday, Sept. 4. This affair inaugurated a new year of activities for the Society. Chester Kruger again is Program Chairman and is assisted by Martin Kasch, John Mack, and Merle Nelson, Miami Valley President. The committee arranged various sports activities in addition to a special hot picnic supper. A miniature golf tournament was scheduled and a showing of the technicolor movie "THE DUPONT STORY."

We regret very much to announce that our Treasurer and Director, Paul A. MacPhee is severing his connection with Miami Valley Section. Mac will become Rubber and Plastics Technologist with the Southwest Research Institute at San Antonio, Texas. That is a long way to go Mac, but we wish you all the good fortune to which you are entitled in your new endeavor. Godspeed.

Detroit Outing

Emil R. Gazdick

On August 6, 1952 the Detroit Section of the SPE held their annual golf outing at the Forest Lake Country Club.

During the day, members and guests tried their luck on the course in posting winning scores. Mr. David McArthur of Reichold Chemical Company, won top honors with the low gross score. Mr. Alvin Stomp of Una Craft Engineering Company, led the other end of the field with his high gross score. This match was Mr. Stomps' maiden game and he claims that due to inexperience, his score was an honest count.

After golf and a cocktail hour, dinner was served, followed by a talk by president Harry Haaxma welcoming guests and new members. Included in his talk was a word of thanks to the golf committee which worked hard at making this meeting such a success. The golf committee with Mr. Carl Whitlock of C. H. Whitlock Associates as chairman consisted of Mr. W. DeGalen of Koppers Co., Mr. D. Hoffman of Evans-Winter-Hebb Inc., Mr. R. Walsh of Monsanto Chemical Company, Mr. Roy Smith of Yardley Plastics, Mr. John Slater of Tennessee Eastman Products Co., Carl Kithill of Celanese Corp., Erik Erikson of Detroit Plastic Products and Harry Haaxma of Wolverine Plastics.

N.W. Penn Notes

Paul Roche

About the only pleasant sign of the fall season I know of is to report the SPE picnic to the Journal. Nat Reyburn (Applied Plastics) was general chairman and did an outstanding job especially considering that he didn't attend. Tony George (Perry Plastics, Inc.) was in charge of the shakedown for door prizes and, large and small, he corraled enough to go around at least twice. Bill Phillips (Presque Isle Plastics) was in charge of liquid refreshments. Stanley Berg (Watson Stillman, etc.) was our sponsor and Paul Roche (NOSCO Plastics) was in charge of reservations. We hereby report that 73 attended, which is an innacurate figure but on the other hand it is consistent with the number of meals that actually got paid for. In the games department Don Leet and Bill Conroy (Erie Resistor Corp. both) took charge of golf while Jerry Comstock (Quinn Berry Corp.) acted as V.P. in charge of horseshoes.

A little birdie told us that Applied Plastics Div'n. (Keystone Brass Works) is contemplating a second plant expansion within a year. In addition to their melamine "Restraware" line we understand that their custom compression and injection moldings are enjoying a happy acceptance.

When the weather for the tool and die business gets too hot "Charlie" Asmus (Erie Die Co.) finds relief in the new Chris-Craft powered boat purchased at the beginning of the season. It will be but a matter of time before the talk will run to restocking Lake Erie.

Byrd Tool & Mold Co. is traditionally adding new equipment, but we note that the latest one is marked "Lester" and they pour powdered styrene in a hopper at the top and pretty castings drop out at the side, like magic yet. We wish them luck in the molding business (what is it they say about "the grass is always greener———") and hope that their position in the plastics mold business will remain unchanged.

NOSCO Plastics has announced the addition of a vacuum-forming department to their Plant #II in East Erie. Having purchased the largest type automatic double-bed type machines yet produced by Industrial Radiant Heating Corp. NOSCO is hot after sheet-forming business in all types of thermoplastics. Dick Hydeman has been assigned to the development of this activity.

BARRIER-PRIBBLE & CO., INC.

554 EBEN STREET, NEW HAVEN, IND.

Wayne Pribble:

That spool job you mentioned last month was a corker, but one job I think you should tell about is the telephone base. Do you remember that the original mold when we took over had a complicated link action wedge and two side cores? And that when we got through it was a simple straight up-and-down compression job and production was doubled?

Maybe folks should KNOW about these things.

Al Barrier

with

METASAP STEARATES

PROBLEM: **How to obtain consistently perfect preforms and better finished products with maximum economy.**

ANSWER: **Plain as the hand of a "Plastiversal" machine in front of your face!**

In photograph A—the hand of the Plastiversal is registering 50 lbs. of pressure—the pressure required, at a leading molding plant, *before* Metasap Calcium Stearate was added to molding compounds. Such preforms were often badly delaminated upon ejection — as shown here.

In photograph B—the hand of the Plastiversal is registering 10 lbs.—all the pressure required to eject the same size preforms when they contained Metasap Calcium Stearate. Such preforms are obtained perfect in shape—as shown here.

Use of Metasap Stearates as lubricants in molding compounds results in:

Perfect Preforms—obtainable with lower ejection pressures.

Better Finished Products—because rapid, easy ejection results in clean-cut pieces with more marketable finish.

All of which means substantial production economies, longer mold life . . . increased output.

METASAP CHEMICAL COMPANY, Harrison, N. J.

Chicago • Boston • Cedartown, Ga. • Richmond, Calif.

POLYETHYLENE

(Continued from Page 12

seat covers. Innumerable items are now molded from the material. Possibly the most important are the squeeze bottles that are fabricated either by blowing or injection molding.

Although polyethylene has only been available for civilian use since the close of World War II, a large number of applications have been worked out in this relatively short time. The number of applications continues to grow almost geometrically so that it has been difficult for supply to catch up with demand. It is anticipated that this situation will correct itself shortly as new production comes in so that polyethylene can continue its rapid growth as one of the most important plastic materials available today.

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MOLDERSCOPE

(Continued from Page 7)

to be an important historical fact which may well be the basis for a review of your own insurance coverage, its terms and amounts. We can only hope the generalized data will be released for vitally interested injection molders when it has become academic fact instead of the vital issue that it is at the moment these lines are being written.

The Molderscope on Hydraulic Maintenance, published November 1951, confused the trade names of two oils. Correct names should have been Sinclair Rubilene, and Texaco Regal.

ABSTRACTS

(Continued from Page 22)

inates are discussed critically. Topics covered include low-loss laminated, metal-clad laminates, postformed laminates, low - pressure - high - strength laminates, alkali-resistant materials.

Wider Design Opportunities With the New Phenolics, Part III. A. E. Javitz. *Electrical Manufacturing,* August 1952.

Discussed are: special types of glass-fiber based laminates of phenolic resins, and phenolic resins laminates based on nylon, orlon, non-woven cotton; melamine-surfaced phenolic-core laminates, impregnated wood laminates, epoxy resins, and the foamed phenolics.

Reprints of this three-part article are available by writing on your letterhead to J. A. Campbell, Director of Reader Service, The Gage Publishing Co., 1250 Sixth Ave., New York 20, N. Y.

(Continued from Page 4)

for running at 150 YPM is simply insurance against future developments in plastic formulations.

We thought you would be interested to know that the Adamson calender not only is not the "fastest calender in the world" but it also is not the first calender geared for 150 yards per minute to have been built and put into operation.

Your very truly
Farrel-Birmingham Company, Inc.
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Advertising Manager

☆ D-20

Committee D-20 on plastics of A.S.T.M. will meet in Boston, Mass., October 27-29.

★ Necrology Dassing

Charles A. Dassing, Technical Representative of the Molding & Extrusion Materials Department of Bakelite Company, passed away on August 29. He was 39 years of age and had been associated with the Bakelite Company for a total of 23 years. He was scheduled to speak at the September meeting of the Chicago Chapter of SPE.

★ Abiatti

SPE regrets the passing of **F. A. Abiatti,** in August. Mr. Abiatti was Vice-president of Monsanto Chemical Co., in charge of plastics. His kind and valuable advice to the SPE appeared under Management Looks at the SPE in the June 1952 SPE Journal.

WATSON-STILLMAN HAS BEEN...

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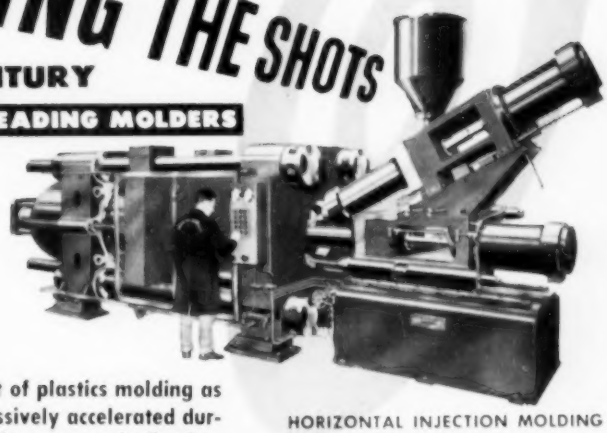


HORIZONTAL INJECTION MOLDING MACHINES—12 TO 300 OUNCES

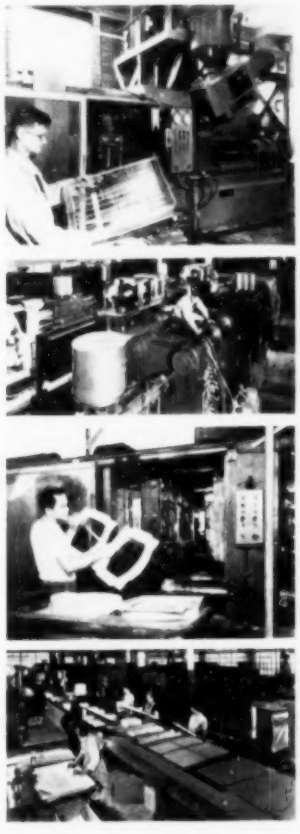
Growth and development of plastics molding as an *industry* has so impressively accelerated during the past few years that we are inclined to regard it as a youngster in *technique*. Actually, most current "innovations" in plastics equipment are rooted in experimental work going back more than 50 years to the days of celluloid collars and the first plastic billiard balls . . . to the pioneering days of Watson-Stillman research in what then gave slight promise of becoming the modern giant plastics industry of today.

Throughout its 50 years of leadership in molding equipment manufacture, Watson-Stillman engineering has continued to "call the shots" on new materials, mold design, improved controls and, above all, on larger machine CAPACITY.

For instance, the presently popular "new" trend toward increasing capacity by means of *preplasticing* units was introduced by Watson-Stillman years ago . . . tested, improved, perfected through original research in shop and field by Watson-Stillman engineers . . . and has been successfully employed on Watson-Stillman units from 12 to 300 ounces capacity for years.

Each and every Watson-Stillman Machine is rated for its minimum capacity. This assures a margin of safety in Production . . . W-S Machines *deliver the goods.*

Today, as for more than fifty years past, it will pay you to consult Watson-Stillman *first* when you are molding by compression, transfer and injection techniques or when planning expansion or a new plant.



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New Books

Techniques of Plant Maintenance, 1952. Published by Clapp and Poliak, Inc., 341 Madison Ave., New York City. 182 pages. $6.00.

Techniques of Plant Maintenance, 1952, is made up of papers presented at the Third Plant Maintenance Show, Philadelphia, January 1952. Typical chapter readings are, How to Maintain Plant Buildings, Preventive Maintenance, Maintenance Problems of the Small Plant, How to maintain Electrical Equipment.

Bakelite Sponsors Multiple Fellowships

Dr. E. R. Weidlein, President, Mellon Institute, Pittsburgh, Pa., announces the establishment of a new Multiple Fellowship to develop uses for resins derived from ethylene and acetylene. The Fellowship, sponsored by the Bakelite Company, a division of Union Carbide and Carbon Corporation, New York, N. Y., will be headed by Dr. Richard W. Quarles, Senior Fellow. His associates will be William H. McKnight, Dr. Edward T. Severs, Walter K. Vollmer, Arthur C. Frechtling, John T. Ingram and Gordon P. Bigelow.

This group has heretofore been a part of the Mutiple Fellowship on Organic Synthesis sustained by the Carbide and Carbon Chemicals Company, another division of Union Carbide and Carbon Corporation.

SIXTH SPE PRIZE PAPER CONTEST

The sixth Prize Paper contest sponsored by the SPE offers prizes of $200, $100 and $50 for the three best original papers dealing with plastics. Papers are first submitted to the nearest local SPE section for local judging; most sections also award substantial prizes independent of the National prizes mentioned above. Winners from the local sections are then submitted for judging in the national contest. Authors outside the United States should submit their entries directly to the SPE, Athens, Ohio.

Subject matter may deal with any phase of the plastics industry, chemistry, materials, molding techniques, tooling, plant maintenance, testing procedures, machinery, sales, education, and the like. There is no length limitation. Entries must be original, and submitted before November 1, 1952. Previously published papers are not admissable. Credit for material taken from other sources must be credited to the original sources. Papers submitted become the property of the SPE. To facilitate judging, five copies of the paper should be submitted, and all drawings in ink on white paper.

A. J. Warner, Technical Director of the Chemical and Physical Laboratories of Federal Telecommunication Laboratories, Nutley, New Jersey, is a native of London, England. He joined the I.T.T. System in 1930 and was transferred to the United States in 1941 to take charge of the Dielectrics Laboratory of the Intelin Division of Federal Telephone and Radio Corporation. Since 1934 he has been actively engaged in research and development in the field of plastics, particularly styrene and its derivatives. Mr. Warner was the founder president of the Newark Society of the Society of Plastics Engineers, was formerly the secretary of Committee D-20 on Plastics of the A.S.T.M., and at present is the Secretary of the 1952 Conference on Electrical Insulation of the National Research Council.

J. H. DuBois, vice-president of Mycalex, Inc., heads the contest committee. The panel of judges consists of four men well-known in the plastics industry.

Frank Reinhart, Assistant Chief of Organic Plastics Section, National Bureau of Standards, is also a national SPE director and member of many technical societies including S.P.I., A.C.S. and A.S.T.M. He contributes a feature to Modern Plastics and is the author of many papers in the field of plastics and adhesives.

Carmen R. Giannotta is with the M. W. Kellogg Company. Thirty-one years old, he received his degree of Bachelor of Chemical Engineering from Pratt Institute, Brooklyn, in 1942. He was until recently the Supervisor of Plastics Laboratory, Naval Ordnance Division, Eastman Kodak and he served as Secretary-Treasurer of the Rochester section of the SPE.

Robert L. Whann has been closely associated with the application of plastics to aircraft at North American Aviation, Inc. for the past ten years. He shared in the development of the postforming process for laminated sheet materials. At the present time, in addition to being supervisor of the Plastics Section of the Engineering Material and Process Group, a position he has held for the past two years, Bob Whann is N.A.A.'s representative in S.P.I. and A.S.T.M. and is an active member of the Southern California Section of SPE.